The Electrical Industry's Weekly Magazine

August 4, 1958

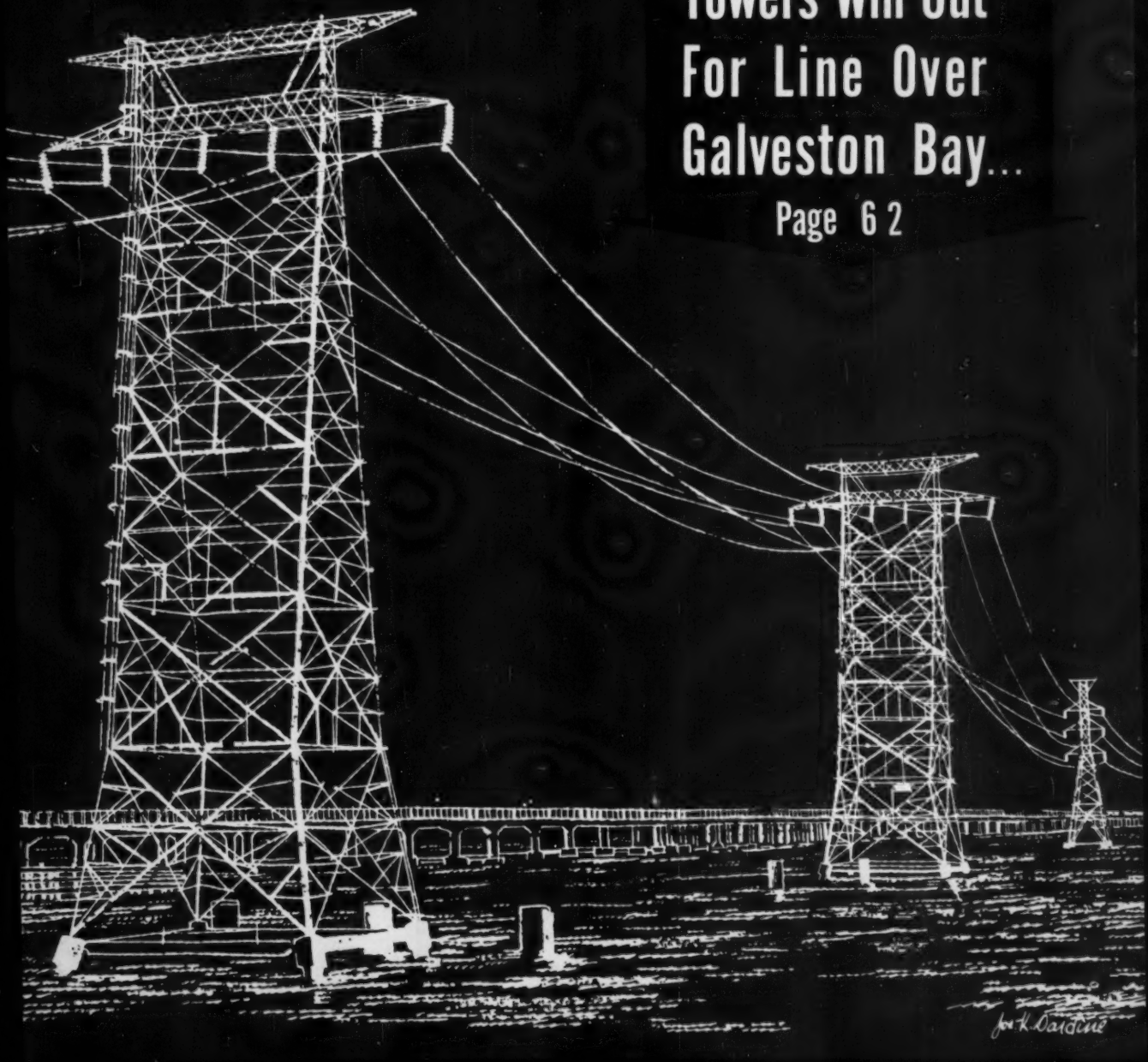
Electrical World

Price 50 Cents

A McGraw-Hill Publication

Towers Win Out For Line Over Galveston Bay...

Page 62



21 Power Lines Don't Deflate Property Values

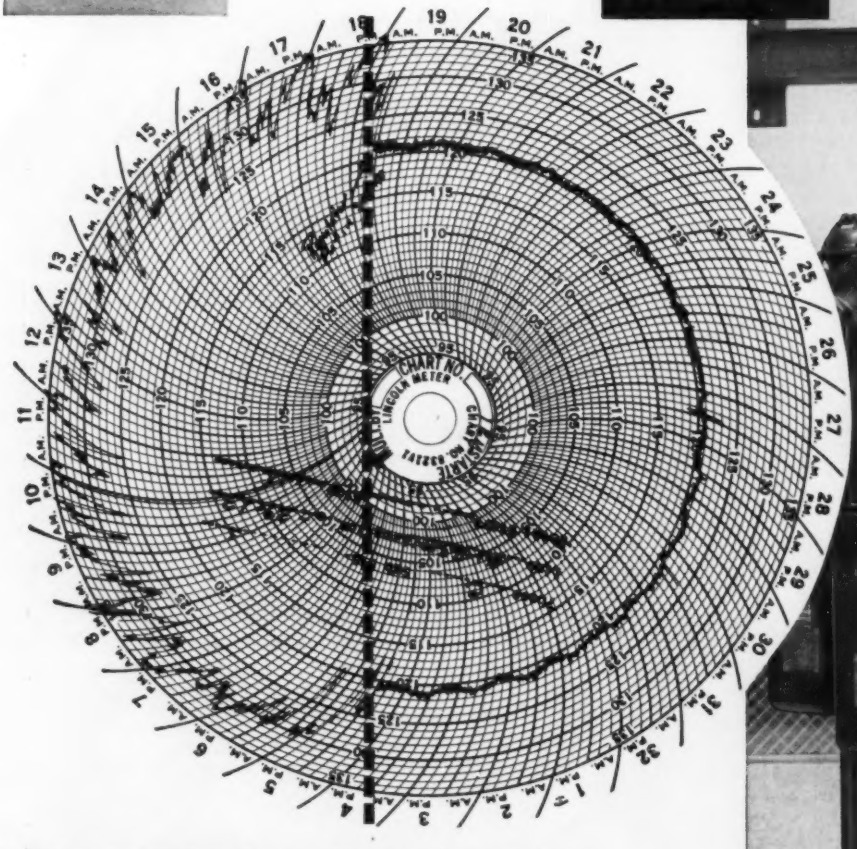
ALLIS-CHALMERS — 25 years of 5/8% step regulator leadership

Solution To:

High Voltage Problem

BEFORE

AFTER



Eliminate fluctuating voltages, burnouts, high voltage complaints by using Allis-Chalmers 5/8% step regulators

This actual chart illustrates how Allis-Chalmers regulators corrected these problems.

Whether your problem is high voltage or low voltage, take advantage of close control with the narrow 1 or 2-volt band width you can maintain using Allis-Chalmers step regulators.

For more information, call your nearby A-C representative, or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

Originators of 5/8% Regulators

ALLIS-CHALMERS

A-5711

Electrical World

Vol. 150, No. 5 AUGUST 4, 1958

Published for 84 years for those engaged in the business of generating, transmitting, distributing, or applying electric power

In This Week's Issue

p 52

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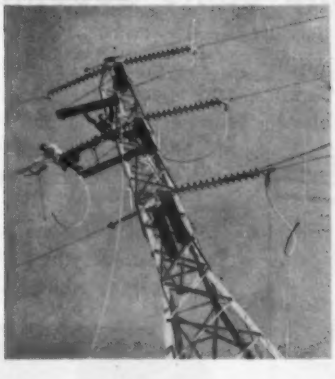

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CURRENT EVENTS

Eastern Utilities Storm-Proof Systems

Construction design improvements are underway to minimize outages like those caused by the March stemwinder..p 52

DISTRIBUTION

46-Kv Reclosers Improve Service Economically

C. R. French, Consumers Power Co

Single-pole type sectionalizes, switches load, improves continuity; 3-pole type betters voltage level, kvar flow.....p 59

Silicone-Insulated Wire Has Wide Use

Perry H. Ware, Simplex Wire & Cable Co

Wire and cables so insulated keep stability in hot and cold ambients; have nuclear power plant applicability.....p 84

MANAGEMENT

Psychology Helps Make Good Bosses Better

W. Grant Loftin, Public Service Co of N. M.

Unique approach to executive development lets key men chat with industrial psychologist few hours a month.....p 64

Training Is a Line Responsibility

Oren P. Stamstad, Union Electric Co

Union Electric makes every boss a teacher and helps the boss as much as it helps the trainee.....p 65

TRANSMISSION

Tower Line Wins Out Over Underwater Cable

Jack H. Horn, Houston Lighting & Power Co

138-kv, steel-tower link costs Houston Lighting 63% of outlay for submarine cable to Galveston Island.....p 62

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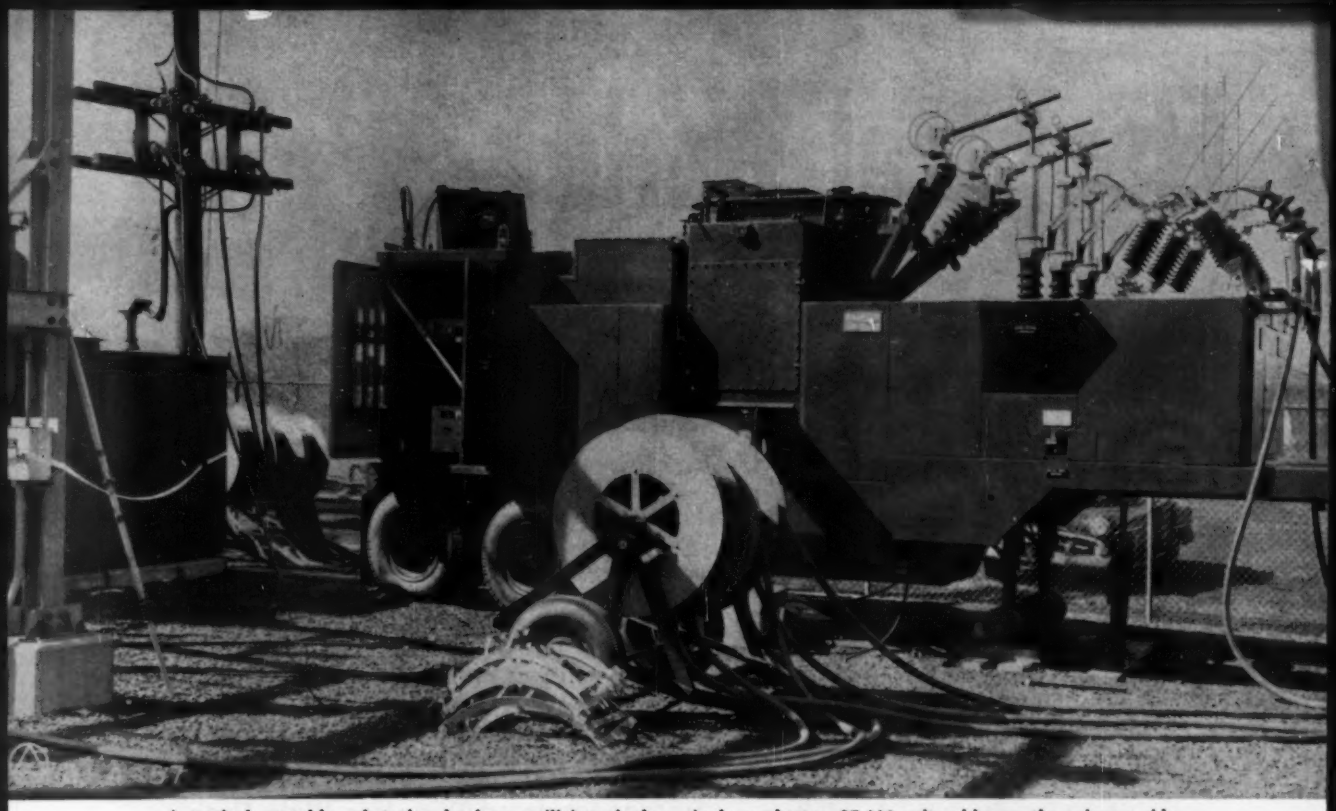
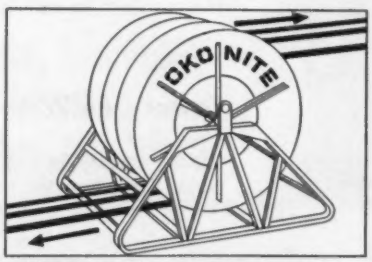


A typical portable substation hook-up utilizing single conductors as recommended by Okonite for portable substation use. Three single-conductor, 5000-volt Okonite substation cables are shown in left background; three single-conductor, 27,000-volt cables on the primary side are in foreground. The three single conductors for each voltage are wound bifilarly on Okonite-designed sectional reels which permit unreeling in two directions at once.

You can reduce substation cutting-in time to minutes by using Okonite-engineered portable cable assemblies

Okonite mobile substation cables provide a compact and functional package engineered to speed up emergency or stand-by substation hook-ups. Cutting in the mobile substation can literally be done in minutes rather than the hours needed with conventional reels, on-the-spot terminations and awkward, heavy cable constructions.

Needed lengths, with permanent factory-molded terminations to fit the customer's needs, are shipped on Okonite-designed reels equipped with clamping devices for the cable terminations and a stand to permit letoff and takeup. Additional features which make this unit fast and easy-operating are a gear drive and a special double-ended winding method, called *bifilar*, which permit both ends of each of three cables to be withdrawn simultaneously. The reel is merely placed at the center of the run and only the required length of cable need be unwound.



Double wind permits both ends of cable to be let off simultaneously.

Designed and built to your needs and specifications, Okonite mobile substation cable and reel assemblies are one more example of Okonite's continuing engineering service to customers.

For more information that will give you totally new ideas on speed and efficiency when tying in mobile substations, ask your Okonite representative or write to The Okonite Company, Passaic, New Jersey.

where there's electrical power... there's **OKONITE CABLE**

6266

Confidence in Business Future

Houston Lighting & Power Co is running a two-page spread advertisement in Texas newspapers under the heading "Evidencing Our Faith in This Area." The ad displays large, high-quality photographs of construction on two generating stations on the Houston L&P system. The text notes that these two stations, being built simultaneously, "are an investment in the future—a pair of strong arms to power the continued progress and advancement of this area and its every resident."

Ads such as this are not new, but they do appear to take on added significance this year when business is generally lagging.

Such ads say very plainly that electric utilities have a very real confidence in the business future and are willing to furnish leadership in licking the economic downturn.

It would be quite timely and quite proper to point out, too, that the utility industry this year is chalking up a record construction mark of around $5 billion.

We believe that such institutional ads as these can do a great deal toward rekindling the pride in growth which seems to have dimmed in the past months.

Fischer Black

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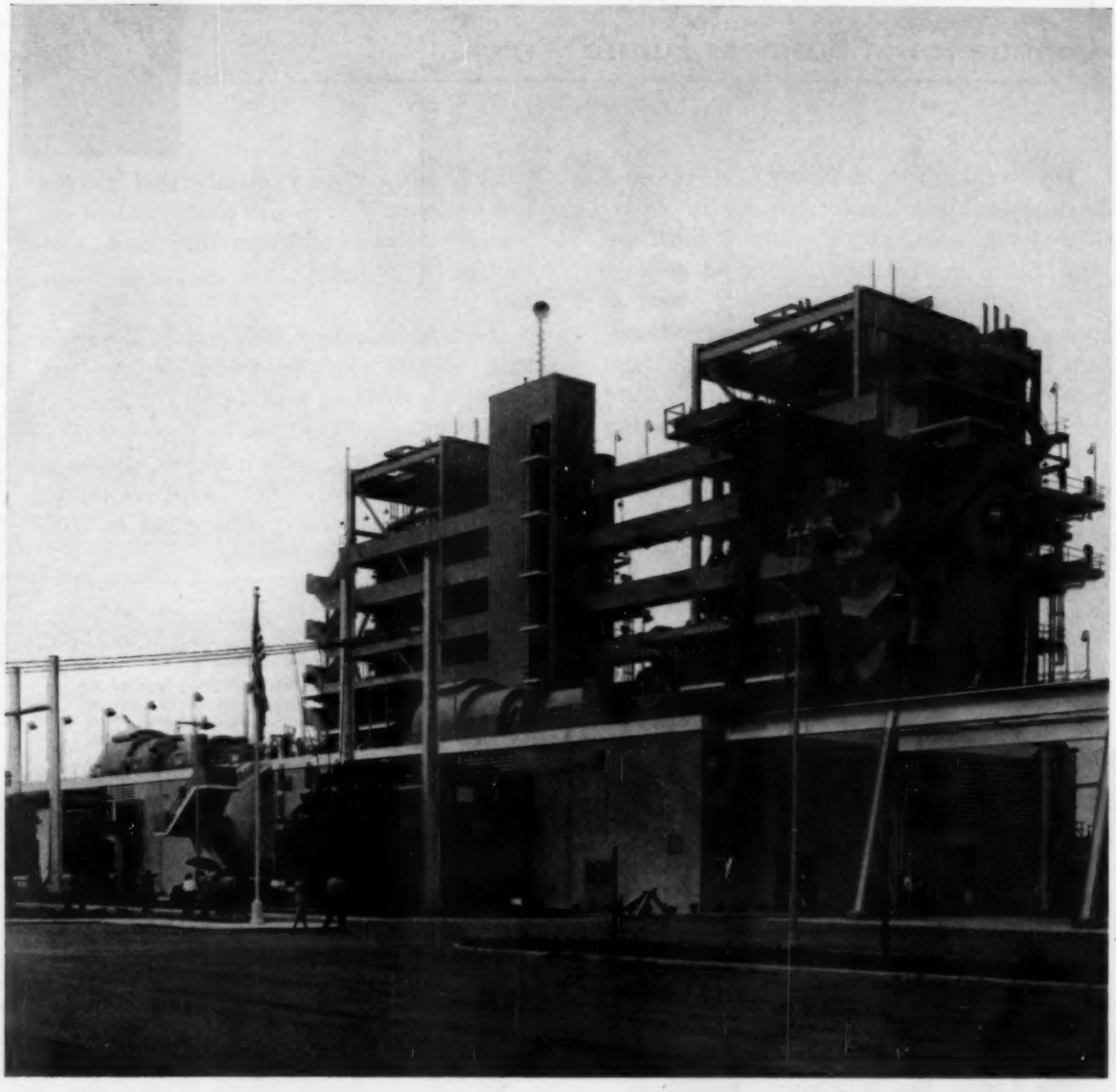


MORE POWER FOR ARIZONA'S GROWTH

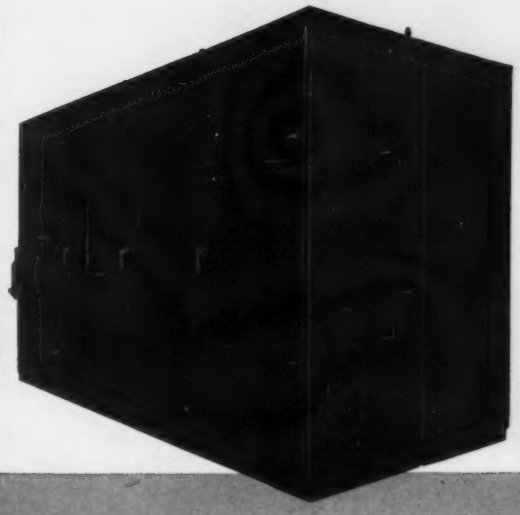
Agua Fria Steam-Electric plant, recently completed at Glendale, Arizona, for the Salt River Power District provides more electric power for the Southwest's rapidly expanding needs.

The plant is a two-unit installation, capable of producing up to 230,000 kilowatts. Simplicity of design and the pleasing appearance of plant and landscaping make it an attractive addition to the Phoenix area.

Bechtel designed, engineered and built Agua Fria, working closely with Power District engineers. Bechtel also engineered and built the District's 100,000-kilowatt Kyrene Steam Plant, completed in 1954.

BECHTEL CORPORATION
Engineers and Builders for Industry
SAN FRANCISCO • Los Angeles • New York • Houston
CANADIAN BECHTEL LIMITED • Toronto • Vancouver

for high voltage service continuity on your critical loads at lower capital outlay— it's S&C Metalclad Switchgear!

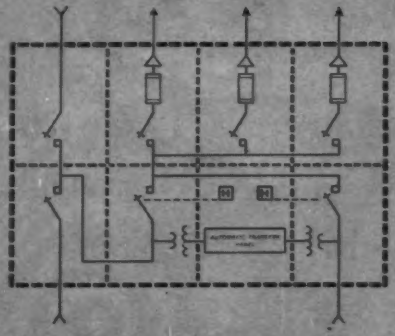


To get service continuity on critical loads, you need preferred-to-emergency switching of your alternate incoming high-voltage supply circuits, and short-circuit protection and switching on your outgoing high-voltage supply feeders. All of this can be provided in one low-cost package in S&C Metalclad Switchgear, as illustrated.

You even have built-in choices of throwover schemes through S&C's standard automatic transfer panels.

You save two ways:

1. You get metalclad switchgear with job-matched load interrupters and power fuses, in lieu of costly circuit breakers.
2. You eliminate cost of custom designing by using an off-the-shelf transfer panel with built-in options.



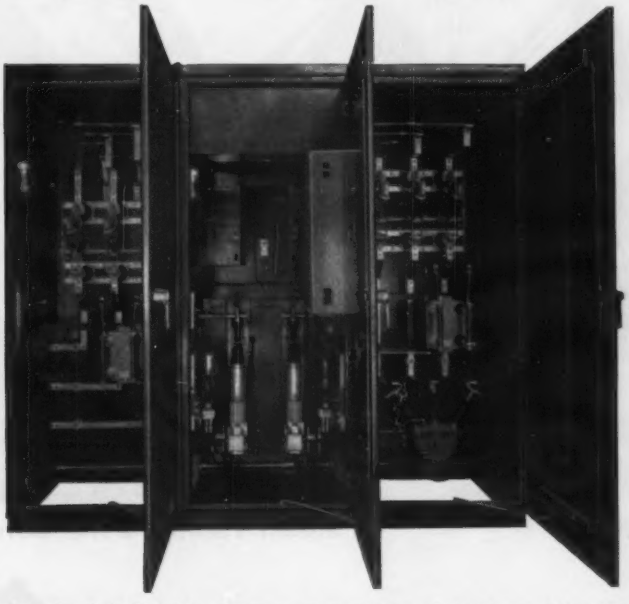
Schematic for 8-bay switching center unit (above) shows throwover control of 2 of 3 alternative incoming sources to provide continuous service for three outgoing feeders.

S&C Standard Automatic Transfer Panel provides for making either source preferred, for automatic or manual return, for adjustable time delays, for choice of returning in either open or closed transition, and for optional lockout on bus faults.

No organic insulation to cause corona trouble; porcelain and air only.

High-Speed Automatic Switching.

Full-length bulkhead doors; rainproof, with complete access.



Super Durabake finish with galvanized and stainless steel hardware; withstands corrosive atmospheres.

Separate compartment for Moto-Draulic operators; free access and decoupling for checkout.

Strip heaters with adequate venting prevents moisture accumulation.

Power Fuses
Tool Operated Disconnects
Open and Enclosed Cutouts
Fuse Links
Loadbuster
Load Interrupters
Metalclad Switchgear

S&C ELECTRIC COMPANY
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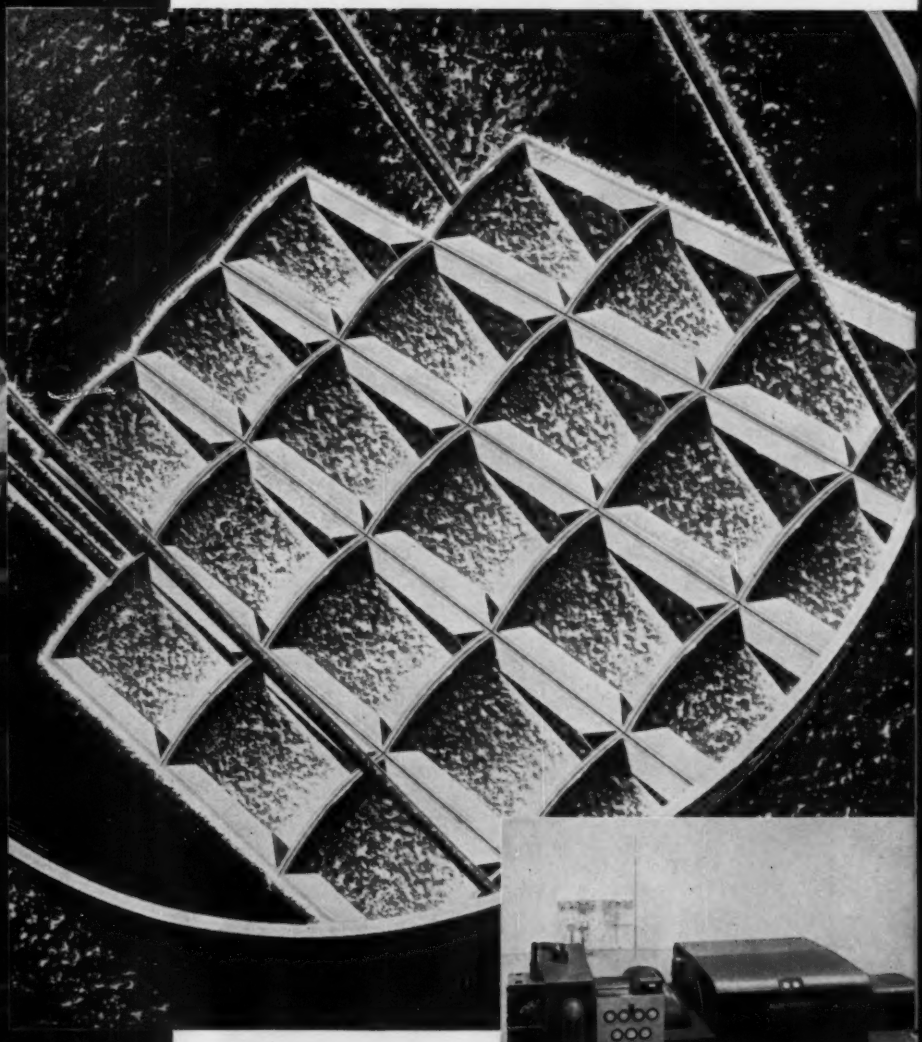
In Canada: S&C Electric Canada, Ltd.
8 Vansco Road, Toronto 14, Ontario

NUCLEAR



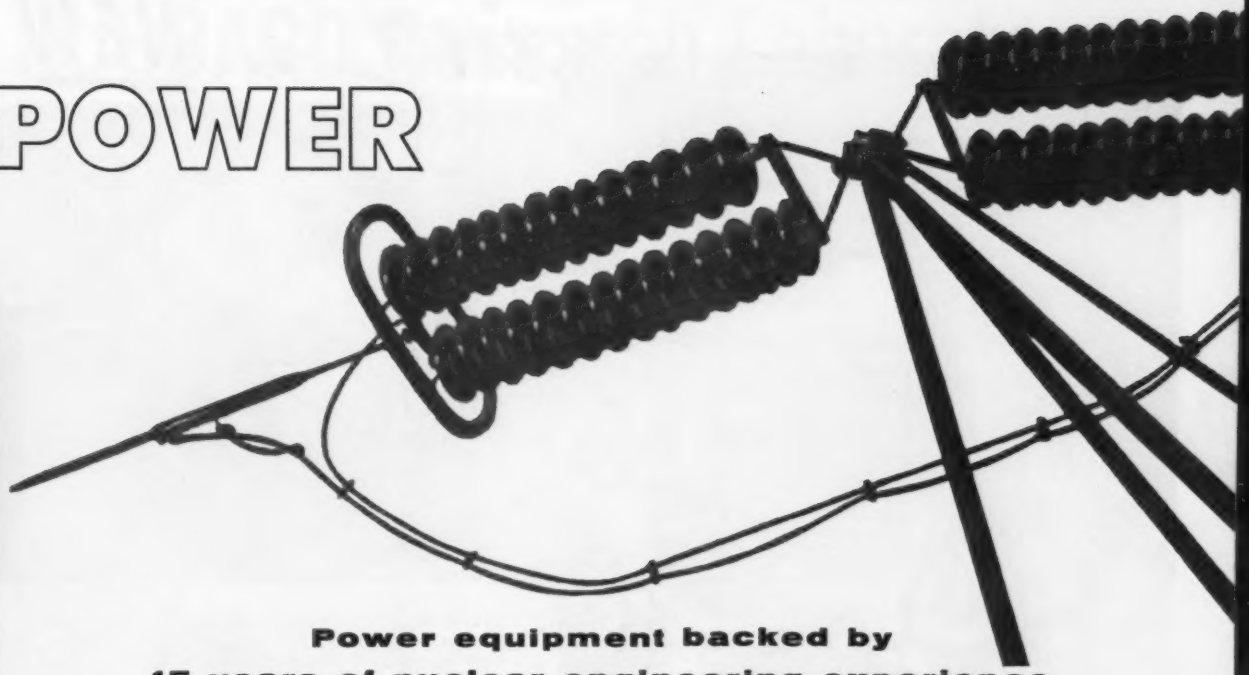
Reactors

Steam Turbine Generators

A-C
ALLIS-CHALMERS

A-5790

POWER



Power equipment backed by 15 years of nuclear engineering experience

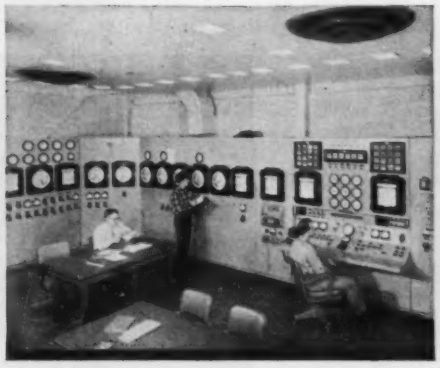
ALLIS-CHALMERS development of nuclear reactors and allied equipment is a logical outgrowth of 75 years of building basic power equipment.

With nuclear experience dating back to the Manhattan Project, facilities, engineering, and production skills are being utilized to produce nuclear power equipment with the same high standards that identify A-C steam turbine generators, condensers, pumps, water conditioning equipment, control, switchgear, breakers, and transformers.

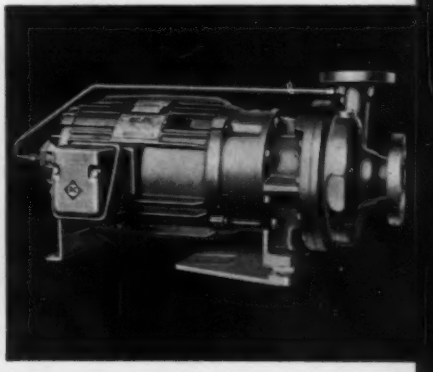
Allis-Chalmers is now engaged in the design and will construct a 66,000-kilowatt nuclear power plant* for the Northern States Power Company in cooperation with ten other electric companies.

Equipment and engineering for all nuclear power plant needs . . .

Condensers



Control and Switchgear

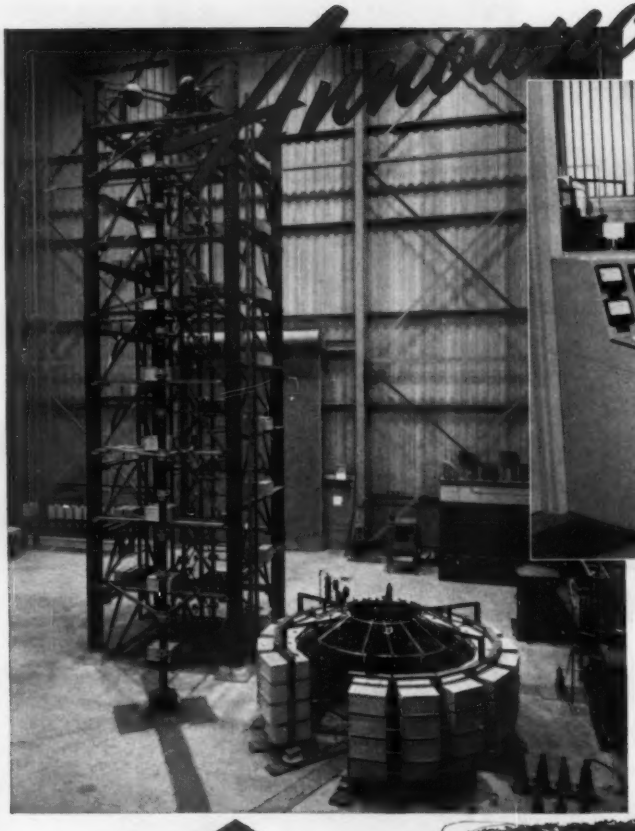


Nuclear Pumps

ALLIS-CHALMERS

*A model of a nuclear power plant using a Controlled Recirculation Boiling Reactor with nuclear superheater will be featured in the Allis-Chalmers exhibit in the United States Exhibition Area, Geneva Atoms for Peace Exhibition.

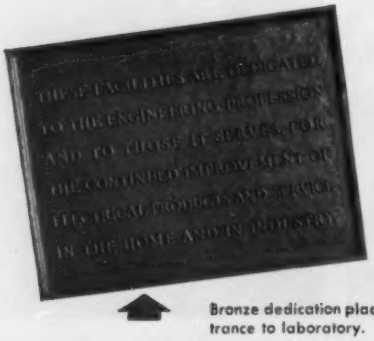
Announcing ... NEW



Nerve center of the laboratory—this master console permits control of all major equipment in both the outdoor and the indoor laboratory. Unique instrumentation includes interlocking controls, high speed recording devices for diverse, precise testing.

Here a 3,200,000 volt surge generator—powerful enough to spark over a 17 foot gap—simulates lightning effects on electrical equipment. High surge current generator is seen in the foreground.

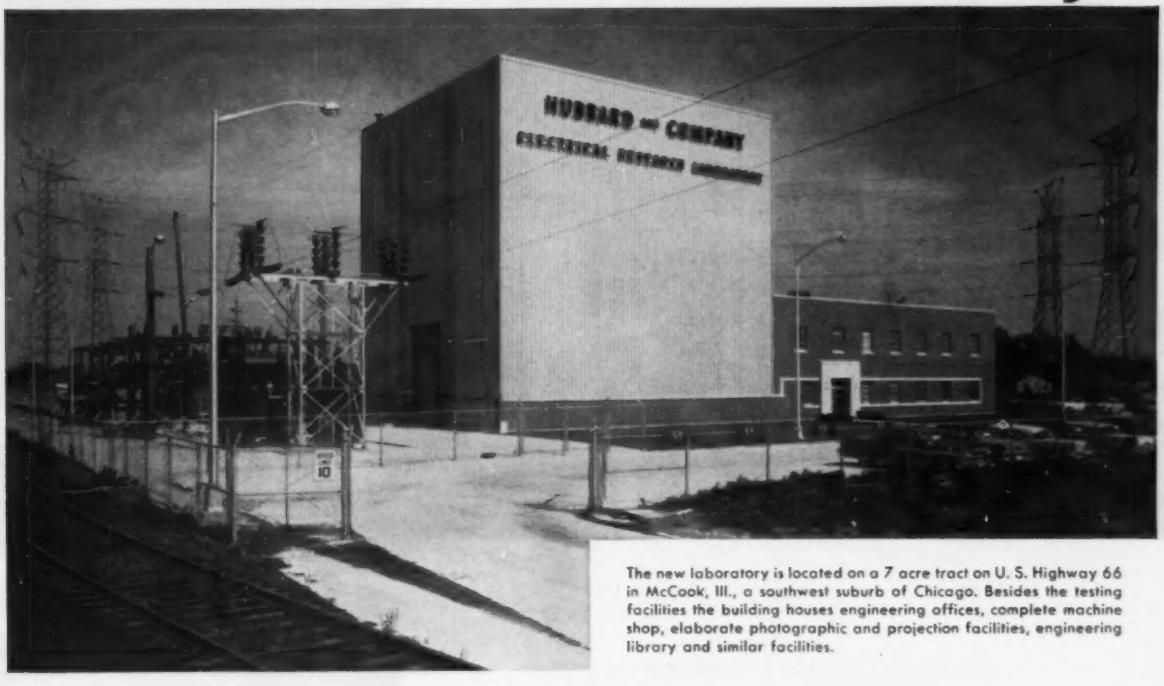
Of the five lightning generators included in the laboratory this 500 kv generator can be adjusted to produce a variety of waveshapes



Bronze dedication plaque at entrance to laboratory.

Outdoor laboratory—for comprehensive electrical and mechanical tests on full scale, live operating systems.

HUBBARD Research Laboratory



The new laboratory is located on a 7 acre tract on U. S. Highway 66 in McCook, Ill., a southwest suburb of Chicago. Besides the testing facilities the building houses engineering offices, complete machine shop, elaborate photographic and projection facilities, engineering library and similar facilities.

What is it worth to KNOW?

What is it worth to know just what is needed in electric distribution equipment...to know just how to make it so that it will stand up under ALL conditions...to know just what steps are necessary to make a particular piece of equipment do a better job than was ever done before?

A number of years ago we reached the decision that KNOWING would be worth *whatever it cost*...and out of this decision came the now completed Hubbard Electrical Research Laboratory. Its purpose is to give new wings to Hubbard product design and development...to do this by integrating all engineering research and testing facilities in one area...to make development, research and testing as it should be ...a creative guild unto itself!

Yes, the laboratory is new; but not the idea on which it was built. Those who know Hubbard equipment realize that the higher standards to which Hubbard equipment has been held across the years is a basic result of the greater emphasis we have always placed on the testing phase. No one has ever gone further into this phase than Hubbard and Company. But now we have gone *still further*.

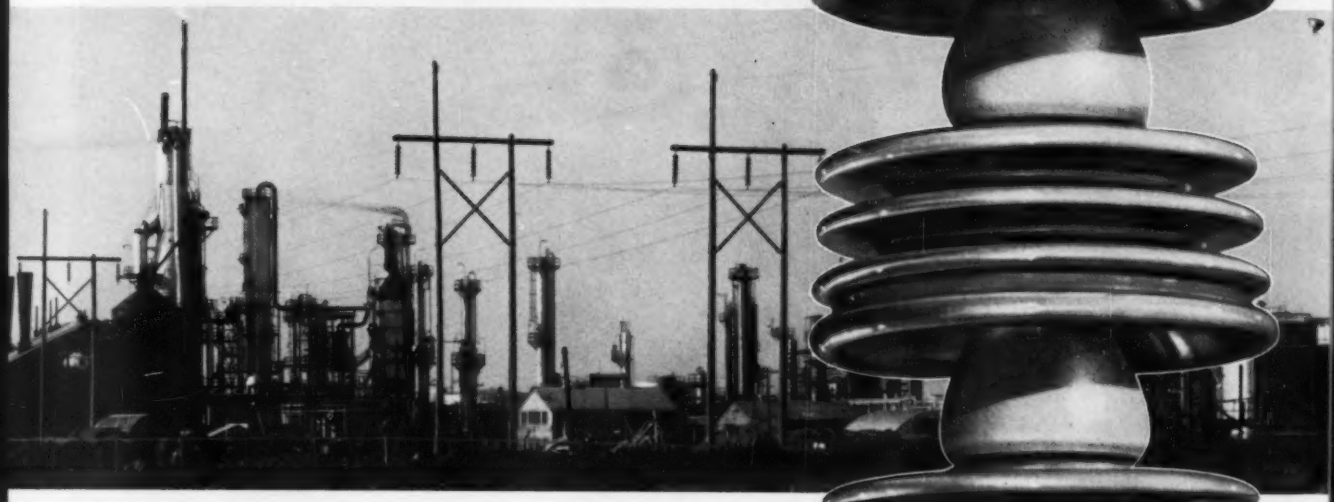
We have literally brought the field into the plant!

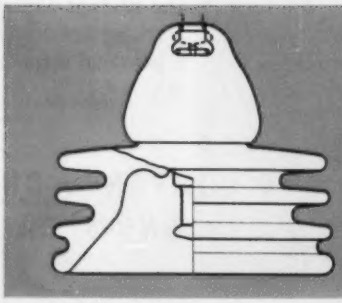
In this research center we can truly duplicate the worst possible conditions under which utility equipment can be expected to function. In it we can determine what to make and how to make it. In it we hope to find the means of solving problems heretofore unsolvable.

A few of the facilities are briefly described here—more fully in a new brochure available for the asking. Those who have an interest in the work we are doing are cordially invited to make a personal inspection of the new laboratory.

HUBBARD AND COMPANY • CHICAGO 50, ILLINOIS

PITTSBURGH 1, PA. • OAKLAND 8, CALIF. • PLANO, TEXAS





Standard-strength (15,000-lb.) Lapp Fog-Type suspension unit for 5¾" or 6½" spacing either ball-socket or clevis type

High-strength (25,000-lb.) Lapp Fog-Type suspension unit for 5¾" or 6½" spacing either ball-socket or clevis type

Contaminated atmosphere?
USE LAPP FOG-TYPES
THE DESIGN WITH 33 YEARS OF SUCCESSFUL SERVICE

Industrial fumes, salt-spray, dust, even automotive exhaust, continually coat your transmission lines with a conductive deposit. Where these conditions are excessive, prevention of insulator flashover becomes a prime operating and maintenance problem.

Lapp Fog-Type insulators offer a complete answer. Their design (a Lapp innovation more than 30 years ago) provides extra length of leakage path—and a *uniform* leakage path. Maximum exposure to contamination . . . to wetting . . . to cleaning action of wind and rain—distributes voltage evenly, prevents leakage flashover. Even in most areas of severe atmospheric contamination, Lapp Fog-Types require no cleaning—where they do, cleaning intervals are longer, and cleaning easier than on other types.

Forward utility thinking now calls for use of Fog-Type insulation on *all* lines in sea-shore or urban locations; it pays off in improved service records and lowered maintenance costs. And the specification of Lapp Fog-Type Suspension Units adds an extra margin of operating security and trouble-free long life.

Lapp Insulator Co., Inc., Le Roy, N. Y.

Lapp

First transistor-powered mobile radios thermostatically protected

General Electric's Progress Line mobile radios now offer transistor advantages in all bands.

New transistorized power supply for both transmitters and receivers means no vibrators to replace, no rotating or vibrating parts to wear out. Transistors, plus high quality silicon rectifiers, give you the most dependable mobile communication known today.

Progress Line mobile radios with transistorized power supplies are available in *all* communication bands: 30 to 100 watts in low band (25-54 mc), 25 or 50 watts in high band (144-174 mc), or 15 watts in UHF band (450-470 mc).

OPERATE FROM EITHER BATTERY POLARITY—Only General Electric's Progress Line lets you operate on either positively or negatively grounded 12 volt batteries. This is especially important in fleet operations.

IMPROVED RANGE—Vibrator hash usually associated with receivers is totally eliminated by the use of transistors. The result is maximum receiver sensitivity.

NOT DAMAGED BY VOLTAGE VARIATIONS—Unlike vibrators, transistorized power supplies can withstand battery voltage variations from +20 to −50 percent.

PROGRESS WITHOUT OBSOLESCENCE—No need to buy new power cable or control head. General Electric Progress Line mobile units with either new transistorized power supply or regular vibrator power supply are *completely interchangeable.*

Call your G-E communications consultant for full details. He's listed under "Radio Communication Equipment" in the Yellow Pages. Or write General Electric Company, Communication Products Department, Section 988-4, Syracuse, N. Y.

Progress Is Our Most Important Product

GENERAL ELECTRIC

TIME IS THE MEASURE OF ALL WOOD PRESERVATION

In business–as in pleasure–it's important to safeguard your investment in wood. Service records show that AMCRECO pressure treatment still provides the longest and most practical protection.

AMCRECO
PRESSURE TREATED WOOD PRODUCTS

AMERICAN CREOSOTING CORPORATION LOUISVILLE 2, KENTUCKY
SUBSIDIARY OF UNION BAG-CAMP PAPER CORPORATION

NEW UTILITY STATIONS, C-E EQUIPPED

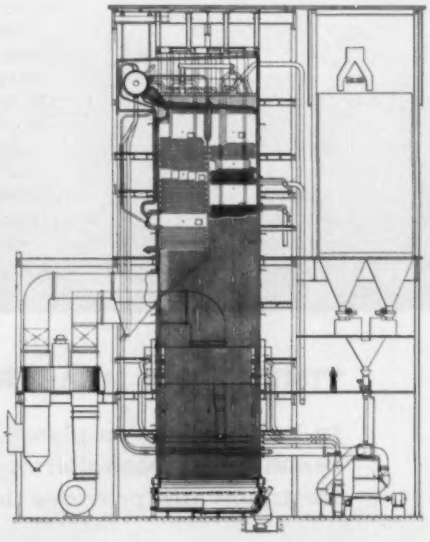
Includes only new stations on new sites placed in operation since JANUARY 1, 1950.

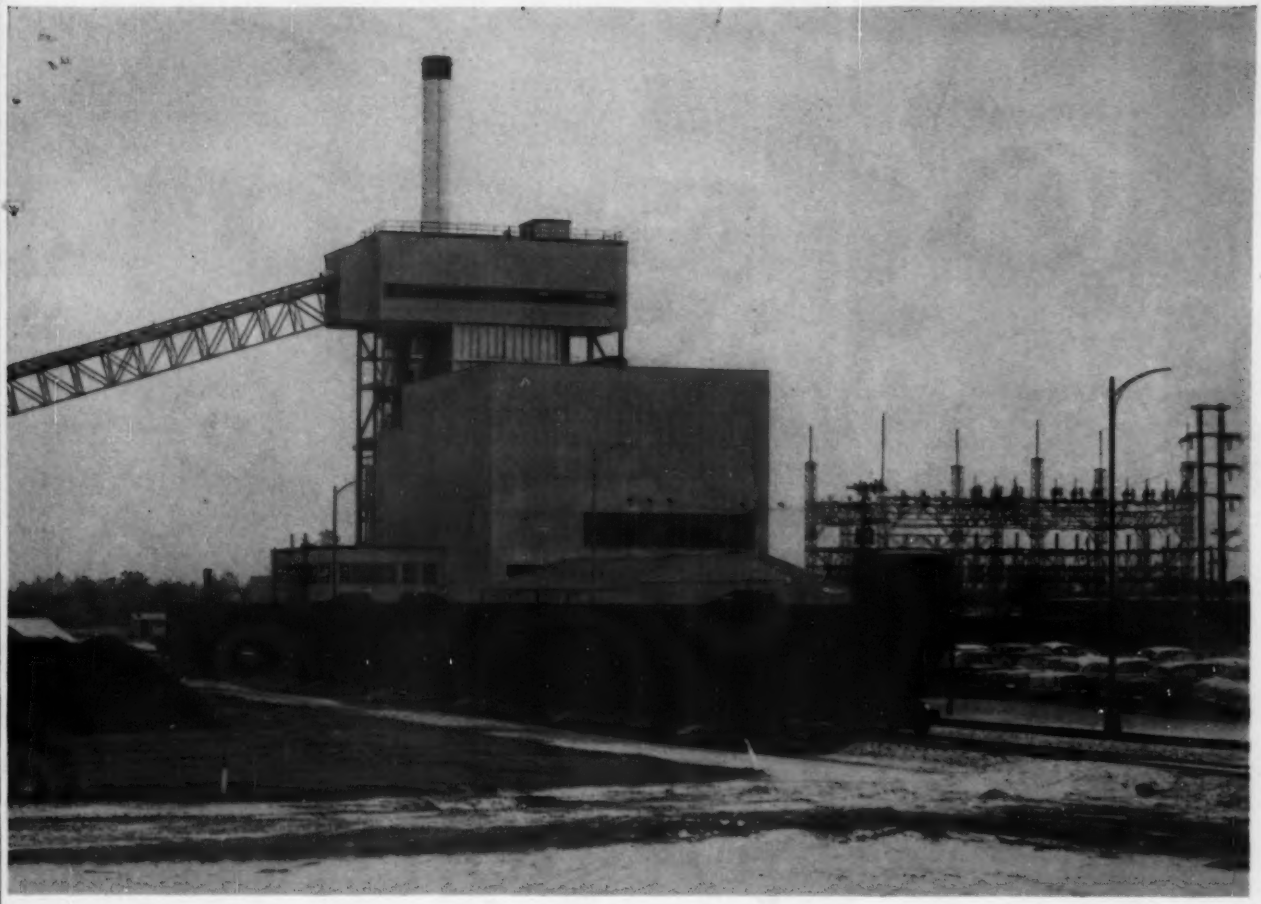
LAKE CATHERINE
HUTCHISON
YATES
DUNKIRK
TITUS
LEE
CONTRA COSTA
HAWTHORN
NINEMILE POINT
EDGE MOOR
PALATKA
JOHNSONVILLE
DANSKAMMER
BECKJORD
HIGHGROVE
PLANT X
BLACK DOG
ALBANY
JOPPA
MERAMEC
PORTSMOUTH
LAKE CREEK
ETIWANDA
AURORA
HENNEPIN
EASTLAKE
OAK CREEK
SUWANNEE RIVER
URQUHART
KINGSTON
SANDOW
MULLERGREN
BARRY
NORTH OMAHA
WILMINGTON
CARBON
SAGUARO
MORRO BAY
VERMILION
JOHN SEVIER
COLLIN
MILLIKEN
GALLATIN
BARRETT
MITCHELL
SAN BERNARDINO
YORKTOWN
GULF COAST
TUCSON

PORT WENTWORTH

New PORT WENTWORTH

The C-E Unit shown at the right is now in service at the Port Wentworth Station. This boiler is of the radiant, reheat type with the reheater section located above the finishing stage of the superheater, directly over the furnace. An economizer section is located below the primary superheater surface in the rear pass, and a regenerative type air heater follows the economizer surface. Steam is produced at 1450 psig and at a temperature of 1000F, reheated to 1000F. The unit is pulverized coal fired using bowl mills and tilting, tangential burners. Oil and/or natural gas may also be used if desired.





STATION goes into service

Unit No. 1 of Savannah Electric & Power Company's new Port Wentworth Station is now in operation. The addition of this plant to the Savannah system completes a fivefold expansion of the Company's capacity over the past ten years. This exceptional growth represents a triumph in management and service in meeting extraordinary expansion in industrial and residential requirements. Stone and Webster Engineering Corporation was the consulting engineer for this new plant on the Savannah River. The initial unit has a name plate rating of 44,000 kw with a capability of 50,000 kw, and station design permits eventual expansion to 500,000 kw.

Port Wentworth No. 1 is distinguished by the use of a reheat turbine generator, the first such application for a rated capacity under 50,000 kw. It is also the first unit of its size ever installed for steam conditions of 1450 psi, 1000F, 1000F reheat. The primary fuel is pulverized coal, with heavy oil as a standby. This is an innovation in the Savannah area, where coal is not generally used as an industrial fuel. The first unit is expected to operate at full load with a station heat rate of 10,000 Btu per kwh, making it the most efficient condensing, extracting steam electric plant of its size in the United States.

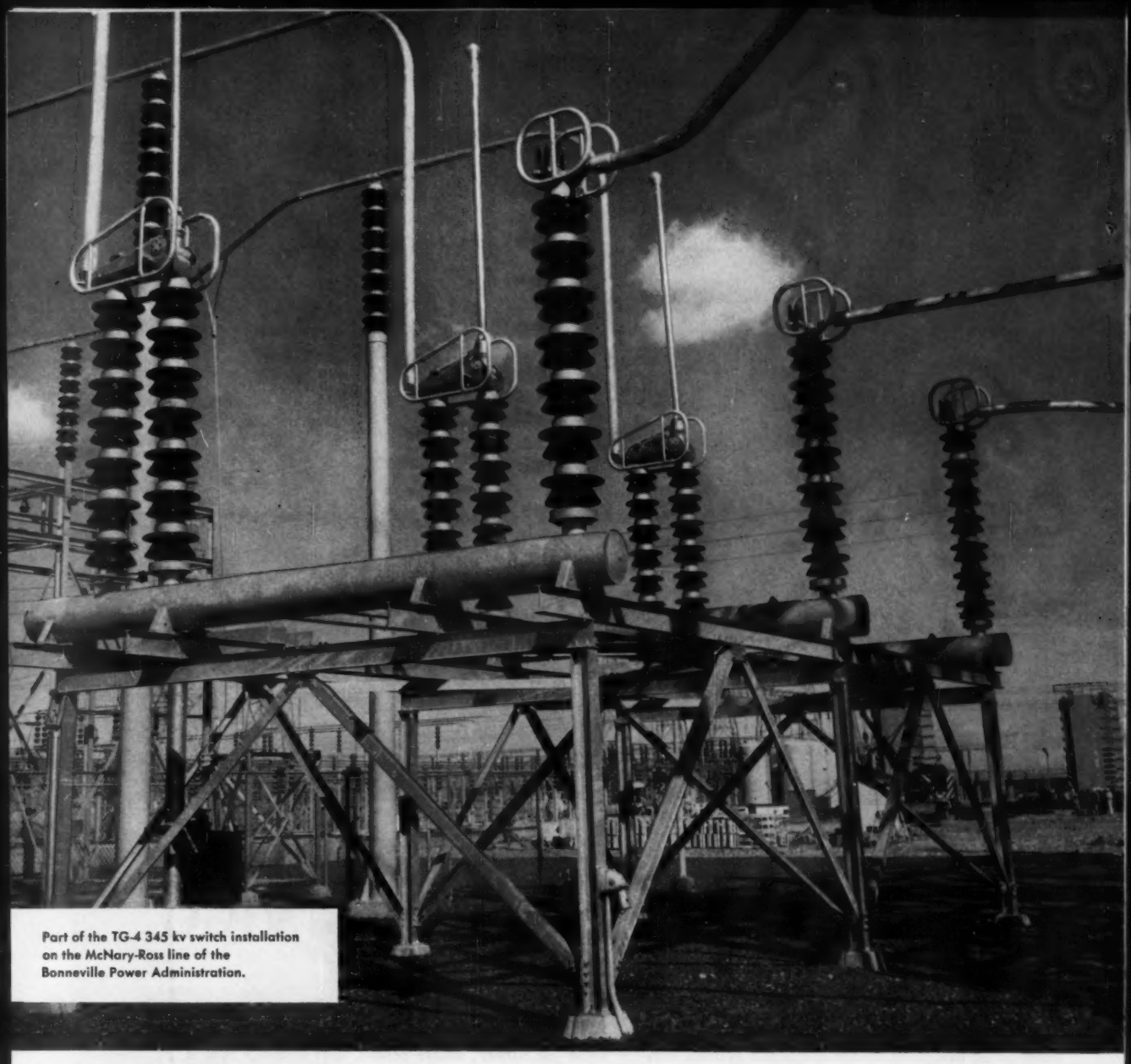
This new unit is served by a C-E Radiant Reheat Boiler of 375,000 pounds per hour capacity. A cross-sectional elevation and a brief description of this boiler appear on the opposite page.

COMBUSTION ENGINEERING

Combustion Engineering Building • 200 Madison Avenue, New York 16, N.Y.

C-166

ALL TYPES OF STEAM GENERATING, FUEL BURNING AND RELATED EQUIPMENT; NUCLEAR REACTORS; PAPER MILL EQUIPMENT; PULVERIZERS; FLASH DRYING SYSTEMS; PRESSURE VESSELS; SOIL PIPE



Part of the TG-4 345 kv switch installation on the McNary-Ross line of the Bonneville Power Administration.

FROM AIR SWITCHES TO COMPLETE SUBSTATIONS A DEPENDABLE SINGLE-SOURCE FOR ALL YOUR SWITCHGEAR REQUIREMENTS

Federal Pacific TG-4 air switches (illustrated above), were among the first in this country to go into service at 345 kv. Providing consistently safe, trouble-free operation, these extra-high-voltage switches demonstrate the switchgear design leadership Federal Pacific offers you.

Of advanced, simplified design, the TG-4 is available in BIL ratings from 1300 to 1800 kv, 1600 amp continuous current and 70,000 amp momentary current ratings to meet the ever-accelerating trend toward higher and higher voltages.

Whatever your needs—switchboards, low voltage metal-enclosed, medium voltage metal-clad, unit substations, power circuit breakers, power switching equipment or complete substations—you can depend upon Federal Pacific for quality switchgear. For further information write Department APR, Federal Pacific Electric Company, 50 Paris Street, Newark 1, N. J.

FEDERAL FPE PACIFIC

Better Products to Control Electricity

The Electrical Week

FUTURE NEWS ▶ **Look for an outsider to become REA deputy administrator,** replacing recently resigned Fred Strong.

LATE NEWS ▶ **Loup River PPD plans to break away** from Nebraska Public Power System. Move could lead to reorganization of state's power setup.

Preliminary highlights of EW's 1958 forecast:

- **Total construction expenditures,** at an all-time high of $5.2 billion in '58, will be cut to $4.6 billion in '59.
- **Distribution construction spending** is the only area of expenditures which will rise in 1959. It will go to $1.6 billion, a jump of 5.7%. Reason: New homes and steady residential-commercial kwhr growth.
- **December '58 peak load** will hit about 113.5-million kw, 6.6 million more than in '57. December '59 peak expected to jump 11.5% to 126.6-million kw. Caution: Reserve margins on the basis of these peaks will become more misleading as utilities shift to summer peaks.

A-power for the Southeast is a step nearer with Carolinas-Virginia Nuclear Power Assn directors' approval of a contract with AEC to build a plant at Parr Shoals, S. C. On-the-line date: mid-1962.

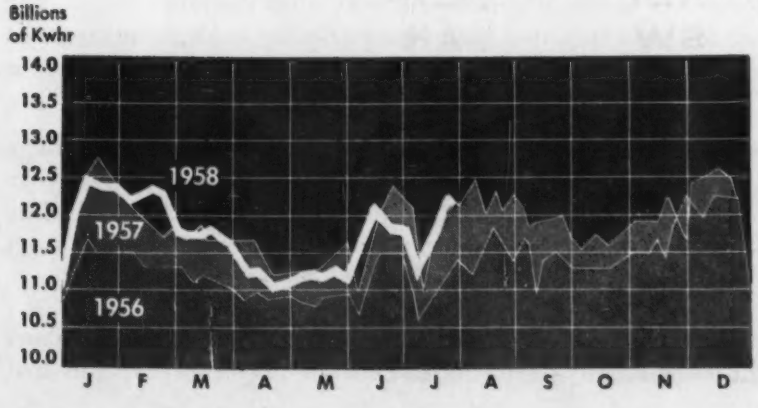
Westinghouse earned $29,973,000 for first six months ($1.70 a share on 17,066,753 shares) vs $30,165,000 for like 1957 period ($1.77 on 16,755,998). New orders for June were highest of any '58 month. Second-quarter consumer product sales up 7.2% over first quarter.

Management changes . . . H. L. Bowen becomes Georgia Power vp . . . GE names G. F. Metcalf vp of new Washington defense activities post.

Cumulative 1958 U. S. electric output was 353.5 billion kwhr, as of July 26, 0.2% under the same period last year.

POWER OUTPUT—Up 0.6%

(Week ending July 26), Kwhr 12,319,000,000



Per Cent Change From Previous Year

	July 12	July 19	July 26
Total U.S.	−0.9	−0.4	+0.6
New Eng.	+5.2	+2.3	+1.4
Mid. Atlantic..	+4.8	+3.1	−0.6
Cent. Ind.	−1.6	−2.6	−3.0
West Cent....	−4.3	−11.3	0.0
Southeast	−0.2	+3.5	+3.7
South Cent. ...	−6.7	+2.0	+8.6
Rocky Mount...	+4.9	+7.6	+8.1
Pacific			
NW	−12.6	−14.3	−13.7
SW	+1.6	+0.7	+2.6

Seasonally Adjusted Index 230.8

Week Ago 232.6 Year Ago 230.5

Source: Edison Electric Institute

A TWO-MINUTE PREVIEW OF THIS ISSUE

EVENTS ▶ **What's the dollar value of downstream power benefits?** This question has been getting more attention from Federal Power Commission. FPC is not only looking at increased power generation of private and other non-federal hydro stations as a result of upstream federal storage, but also at increases in dependable hydro-generating capacity, an item which is a lot harder to pin down. What will FPC's next move be? (p 55).

STORM DAMAGE ▶ **The March snow storm that raged over the East Coast** was the worst ever in the area. Destruction was capable of description only through superlatives: steel towers literally crumpled under loads 3½ times greater than design loads, one string of 22 towers completely wiped out, 100,000 distribution conductors broken, 1.6 million customers blacked out. An exclusive EW report tells why storm tested systems suffered damage exceeding $10 million, and what could be done to help prevent a similar catastrophe elsewhere (p 52).

TRANSMISSION ▶ **Hurricane-exposed Galveston** has a new and reliable power supply. Rather than lay a 138-kv submarine power cable under Galveston Bay to the island city, Houston Lighting & Power Co erected an overwater line capable of withstanding 150-mph winds; saved 63% of the cost of a submarine cable of equal capacity (p 62).

SUBSTATIONS ▶ **Now it's a cinch** for regular maintenance personnel to detect arc-formed gas in oil-filled transformers. It takes 10-15 min. to pass a sample of the gas through a special glass testing tube, which changes color if arc-formed gas is present (p 94).

Ever unlock a gate when you weren't supposed to? Chances are you'd be foiled in your attempt at Florida Power Corp, where locks are now placed on the inside of gates in substation fences. Safety is doubly assured by placing a plastic disk between the padlock and operating rod (p 98).

DISTRIBUTION ▶ **Silicon rubber, once a laboratory curiosity,** is coming into its own as an electrical insulator. Resistance to high (200 C) and low (—100 C) temperatures is one of silicon rubber's most desirable traits. The future for this compound holds many possible applications, some of which are in the nuclear field, due to the fact that silicon rubber is unaffected by atomic radiation (p 84).

Lower costs make reclosers attractive for use in outlying areas where fault duty is moderate. Consumers Power Co uses two types of 46-kv reclosers; one, a single-pole type, sectionalizes and switches load while improving continuity, the other, a 3-pole type, betters voltage level and kvar flow (p 59).

RIGHTS OF WAY ▶ **Rights-of-way rarely affect adjacent property values.** And they don't blight a community's growth. But so few people believe this that

utilities must often pay "damages" where no damage exists. At least a dozen utilities have compiled solid proof—saving both dollars and good will in their right-of-way transactions. Says one RW man: "Our first study has already paid for itself many times over" **(p 121).**

MANAGEMENT ▶ **Psychology makes good executives better,** and helps spot top candidates for future management duty at Public Service Co of New Mexico. There, key executives chat a few hours each month with an industrial psychologist, whose aim is to develop the individual's potential, helping him to grow so as to deal more capably with the company's problems. By making psychology's resources available to its executives, the utility has brought about a general improvement in its human resources **(p 64).**

Make every boss a teacher; it'll do him as much good as it will his pupils. Management sometimes regards instruction as a special staff function, but today training is becoming a line responsibility, a part of the daily business. Learn how Union Electric Co has implemented a three-phase coaching cycle of delegation, observation and counseling to help put training on the level where it does the most good for everyone **(p 65).**

SELLING ▶ **A new lighting system which delivers 200-ft candles** to work areas is paying off in better employee efficiency and morale, leading to a product producing fewer customer complaints . . . Corrugated cardboard scrap is handled electrically, doubling the production rate of a waste paper plant, while cutting labor in half **(p 129).**

MANUFACTURERS ▶ **A line of more than 1000 different types** of pre-insulated underground connectors is now being produced . . . The first national conference on the application of electrical insulation will be held September 3-5 at Cleveland. Total of 130 papers will be presented to the 1,500 persons expected to attend . . . A ⅜-in. Mylar plastic rope has been given credit for pulling four 500-Mcm cables through 162-ft of 4-in. conduit . . . A low cost system for remote or automatic control of HPL-C metal enclosed interrupter switches has been developed **(p 100).**

NEW EQUIPMENT ▶ **You can purify transformer insulating oil** in the field with a mobile oil reclaimer which removes water, sludge, acids and other oil oxidation products, dissolved paint, bushing compound, metallic soap, and other contaminants . . . A moving furnace probe with thermocouple attached measures temperatures to guide operator during furnace firing procedures **(p 109).**

PEOPLE ▶ **West Penn Electric Co** has elected three new vice presidents: Charles B. Finch, Hugh D. McDowell, and E. Wallace Wilkinson . . . William H. Balentine has been made a vice president of Thomas A. Edison Industries, McGraw Edison Co **(p 134).**

Freezing, osmosis, immiscible liquids, ion exchange, precipitation and algae action are methods of obtaining fresh water from the sea currently under study. Long-tube vertical evaporator method is the cheapest of the desalting methods in operation (50 cents per 1,000 gal—1955 estimate) but even this is higher than the highest cost of typical present delivered fresh-water costs. **—B.G.A. Skrotski, Power, July 1958.**

TECHNICAL NOTES

Increasing the pressure in the gas bubbles generated by arcing in oil between opening breaker contacts increases the voltage at which the breaker is essentially free of restrikes. Increasing the pressure decreases the size of the gas bubbles, and increases the dielectric strength in rough proportion to the increase in pressure.

Presence of bubbles in the insulating structure of gas sealed power transformers can cause substantial reductions in dielectric strength of the transformer windings. The bubble evolution is caused by agitation of oil that is supersaturated with gas.

Heat released in a ground fault through an arc does not change with the square of the current as in a permanent ground fault. The power in the arc increases with the current in a less than linear way.

Using the governor motor position as the feedback signal in a load control system is not always desirable because of excessive hysteresis and non-linearity between the motor position and generator output.

FROM EDITORS IN THE FIELD

Nuclear research reactor developed 530 Mw (t) in less than one sec. Known as KEWB (Kinetic Experiment on Water Boilers) the 50-kv aqueous homogeneous reactor shut itself off without sustaining any damage.

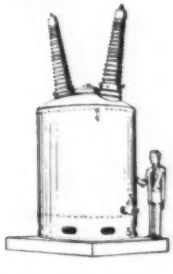
Remote lightoff of burners used for Louisiana Power & Light Co's new 210-Mw Sterlington unit helped get the unit back on the line quicker following an accidental trip.

Scheme to utilize A-power without an intermediary turbine is being developed by Mitchell Engineering, London. New plan employs spinning of reactor core, which is coupled directly to driving shaft.

STRENGTH

of the RIGHT kind... in the RIGHT place

Bushings work for you this way /, but they travel and arrive on the job this way —. Design adequate for this position / may not be enough for this —.



Shocks beyond the line of duty can cause radial displacement of bushing parts. Roads, concrete or steel, may have bumps. Freight handlers may be a bit butter-fingered.

These extra demands--demands separate from conventional operating requirements--have been anticipated in O-B bushing design.

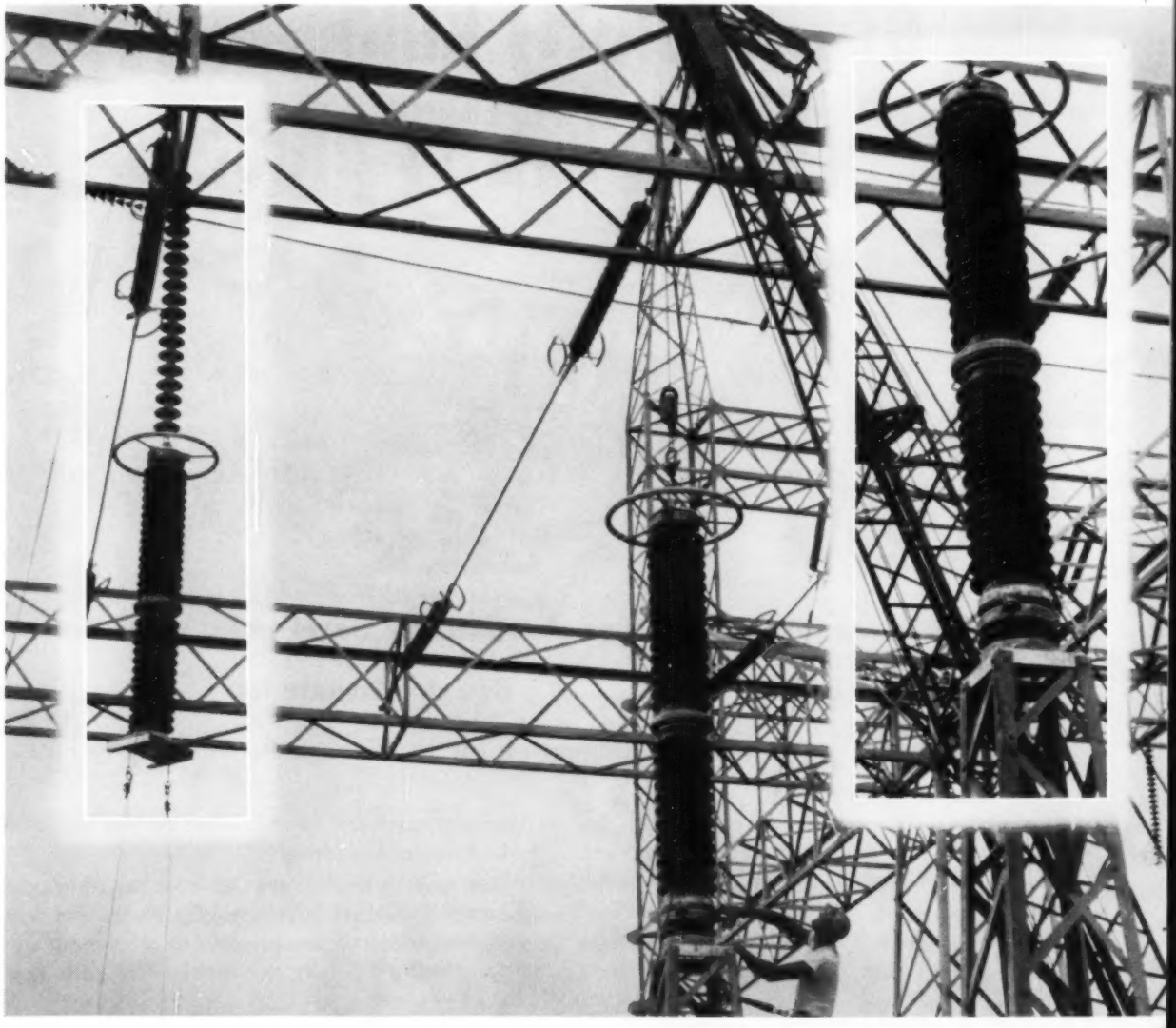
Massive coil springs, imposing uniform axial force over considerable amplitude of movement, maintain rigid assembly to meet all predictable demands. For the *un*-predictable cases, they provide proper yield and complete recovery. Gasket materials are specially selected to avoid a "slippery" joint. Metal surfaces are machined to trap these gaskets and gain added mechanical strength.

Ability to arrive on the job with their superior qualities intact has been carefully engineered into O-B bushings. And they are easy to get without any price premium. Simply *ask for them* on your new station apparatus.

OHIO BRASS COMPANY, MANSFIELD, OHIO

Ohio Brass

PUT THEM



Proof of Thorex flexibility. One 345-kv arrester pole is suspended from a station cross-member without any special provisions, due to its light weight. The other two poles "double" for station insulator stacks in stabilizing flexible jumper loops and are, therefore, mounted on regular pedestals. Shipped, handled, and installed in one piece; their erection time is almost negligible. With these unique advantages, the new Thorex Dynagap ushers-in a whole new order of surge durability, contamination resistance, high protective ability, and construction convenience.

ANYWHERE CHEAPLY!

O-B THOREX DYNAGAP LIGHTNING ARRESTERS

COMBINE TODAY'S BEST PROTECTION WITH...

small size
light weight
construction flexibility
lowest installed cost

- Only 9½ feet tall and 1050 pounds *for a complete 345-kv lightning arrester* . . . Lower voltage models are much smaller, much lighter.
- From shipping crate to final position in a minute or two.
- Manufactured, packed, handled, and erected in one single piece.
- Supported on a plain pedestal or suspended from station steelwork, with no special provisions.

Put your own value on time, material, and space saving. It will probably go a long way toward paying for the arrester.

All this convenience--all these economies --come to you in addition to a totally new order of equipment protection and contamination resistance.

See what really modern design has brought to the high voltage lightning arrester art. Investigate the new Thorex Dynagap Type MPR for voltages 92 kv and above. And remember, identical parts and comparable performance will be found in all other Dynagap models down to 3 kv.

OHIO BRASS COMPANY, MANSFIELD, OHIO

Ohio Brass

NAME IT

...and you can have it!

You can get O-B Insulation on new switches and package substations *if you ask for it*— your own records will justify the slight trouble

Some people think all switch and bus insulators are alike. *Do your own records say this?*

You can find out, in your own office, from information gathered on your own terms, and free from all salesmen's claims, just how *unlike* switch and bus insulators may be. You can tell when they were installed, what replacements, if any, have been made, and why.

If your experience is typical, you will discover that O-B insulators have consistently out-lived others. Since prices are similar, this means you got better mileage on your invested capital. You also saved the time, cost, and inconvenience of repair work.

Switchgear and package substation manufacturers don't know what insulator you prefer *until you name it*. Specify O-B. Your own records will justify this small extra trouble.

OHIO BRASS COMPANY, MANSFIELD, OHIO
Canadian Ohio Brass Co., Ltd., Niagara Falls, Ont.

Ohio Brass

C D F HANDLES THE COMPLETE JOB An oil circuit breaker component is made from two Dilecto laminated plastic tubes, with a threaded ring joining the assembly. From raw materials to finish machining C-D-F does it all!

Utilities can depend on equipment containing C D F Insulating Parts

The reliable operation and long life of heavy electrical equipment often depends on insulating parts. A good supplier of insulation draws from past experience to make this possible—C-D-F has been a recognized industry leader since 1895! A good supplier expands his research and technical skill consistently—C-D-F offers the *widest range of electrical insulating materials*, from Vulcanized Fibre to C-D-F Products of Teflon.*

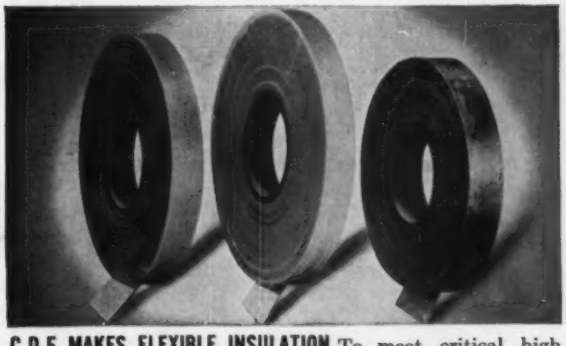
A BIG, RELIABLE SOURCE OF SUPPLY

As a buyer of Utility Electrical Equipment, you gain when your manufacturers work with C-D-F. Quality and dependability of electrical insulation, at reasonable cost, are guaranteed. The latest technical advances and ideas can flow freely between you and C-D-F's engineers. This page shows only a few of the many products C-D-F makes and fabricates for the electrical industry. Consult Sweet's Design File for catalog information, or call your C-D-F sales engineer (sales offices in principal cities)—you'll find he's a good man to know!

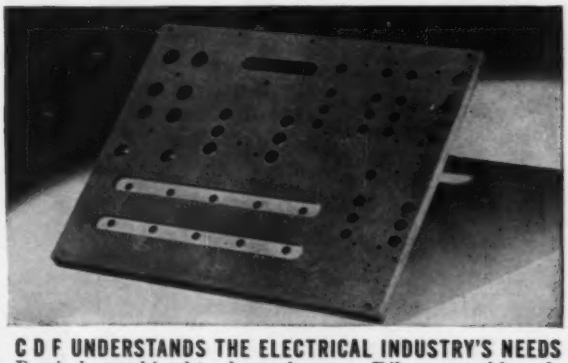
*Du Pont Trademark

CONTINENTAL-DIAMOND FIBRE

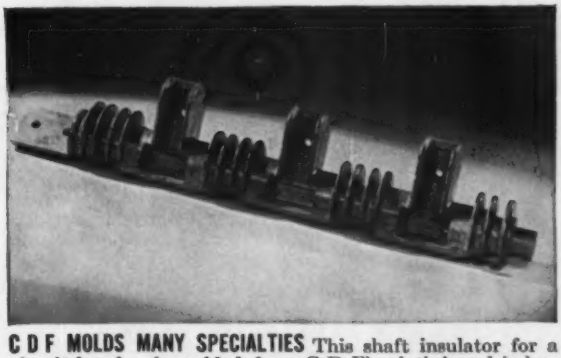
A SUBSIDIARY OF THE Budd COMPANY • NEWARK 15, DEL.



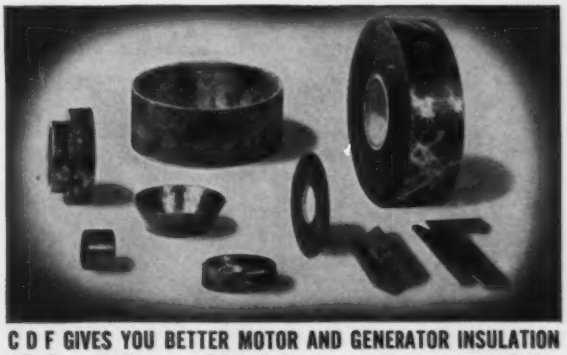
C D F MAKES FLEXIBLE INSULATION To meet critical high heat and electrical insulating needs, C-D-F makes these efficient, easy-to-apply tapes. Size range is wide, with latest resins and backing materials used. Write for samples and technical bulletins of Silicone, Teflon, and Micabond tapes.



C D F UNDERSTANDS THE ELECTRICAL INDUSTRY'S NEEDS Precisely machined to close tolerances, Dilecto panel boards guarantee dependable insulation, help designers save space. New C-D-F Dilecto catalog is yours for the asking, lists all new grades.



C D F MOLDS MANY SPECIALTIES This shaft insulator for a circuit breaker is molded from C-D-F's cloth-based industrial thermosetting plastic, Celoron. Note complexity of mold, clean detailing. Celoron has high impact strength, is used in switchgear.



C D F GIVES YOU BETTER MOTOR AND GENERATOR INSULATION All these built-up and bonded mica products are made by C-D-F to provide uniform high-heat resistance and dielectric strength. All forms of Micabond are made for better performance and lower costs.

A BOLD NEW CONCEPT

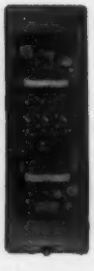
IN DISTANCE RELAYING . . . K-Dar

To provide the increased phase fault protection and system continuity so important on today's transmission lines, Westinghouse developed a completely new technique for high-speed directional distance relaying.

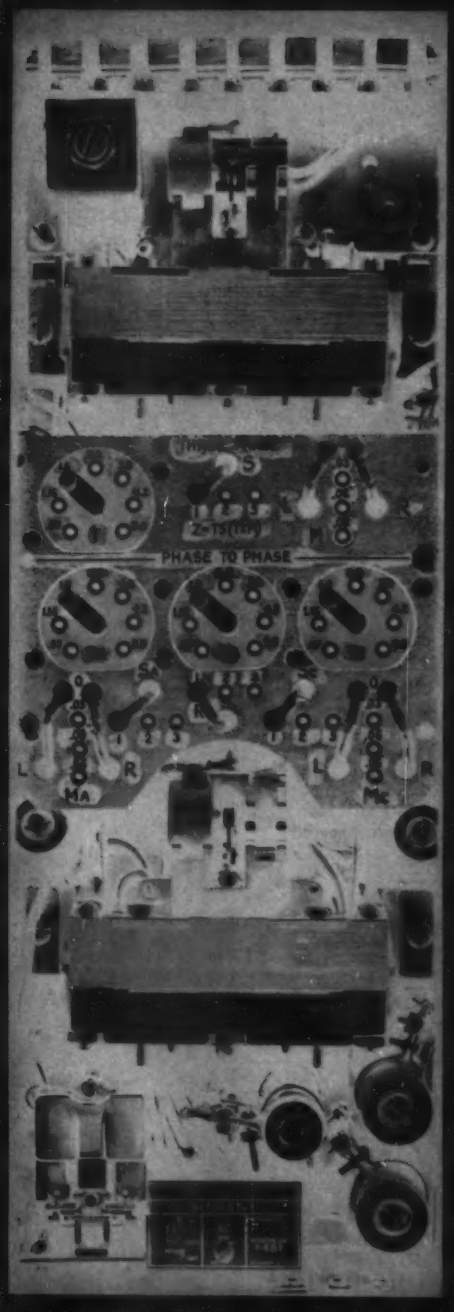
Central intelligence of this new K-Dar relay system is an air-gap transformer that serves as a compensator . . . making the relay system insensitive to d-c transients. The increased relay accuracy thus gained permits considerably more line coverage and a new high in system stability. Individual relays in the K-Dar system also provide complete three-phase protection in a single zone. These high-speed relays have a range from 0.75 to 20 ohms.

The K-Dar system was engineered as a coordinated unit with the new, completely transistorized Westinghouse KR carrier. Working as a team, they provide instantaneous tripping of relays on both ends of a faulted section . . . for 100 percent coverage of the line.

For complete information about the extra protection K-Dar carrier relaying can offer your system, call your Westinghouse sales engineer or write to Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-40502

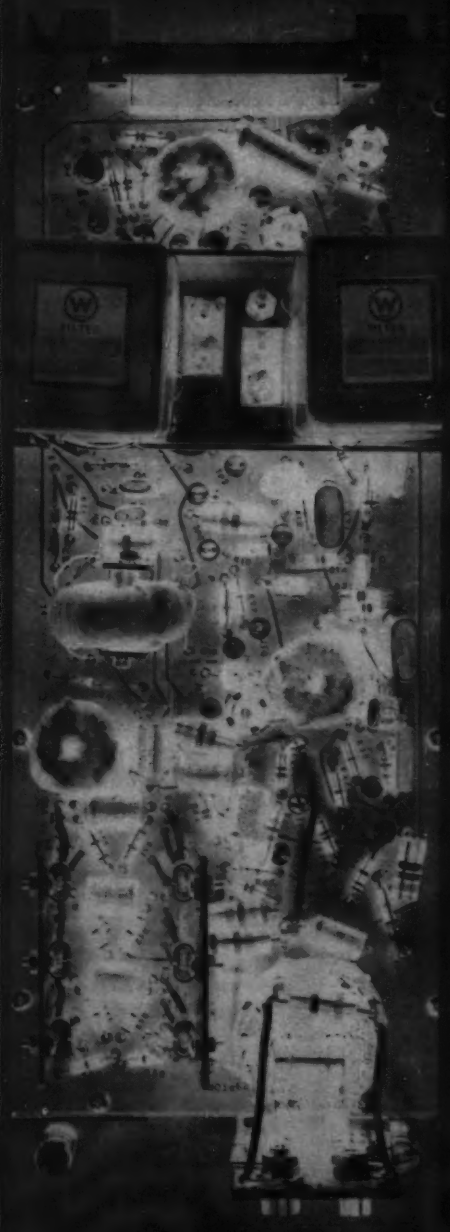


YOU CAN BE SURE...IF IT'S Westinghouse



K-Dar DISTANCE RELAYING

Number of moving parts cut in half. Phase-to-phase settings reach further because relays operate independent of load current or system swing.



KR TRANSISTORIZED CARRIER

KR ends tube replacement. Cooler operation . . . longer life for all components. Besides top reliability, KR uses 1/10 power, needs 1/20 space of conventional equipment.

Scientific tree care needs scientific skills, too!

The treatment in this case was only the skilled application of a mallet and chisel. However, it took the trained eye of a Bartlett Tree Expert to observe from the slightly flattened contour at the base of this otherwise healthy tree, that under the soil it was in the process of self-destruction by the girdling embrace of one of its own roots. Diagnosis and treatment not unlike the teamwork of the physician and surgeon.

A shade tree with its own life process and susceptibility to disease often requires scientific skills that can be acquired only through long years of study and research. Similar to human ailments, tree infirmities that are neglected or improperly treated may result in serious losses. Only through scientific care can America's rich heritage of shade trees be preserved.

Scientific tree care is available to you through your local Bartlett representative, a highly skilled technician backed by the knowledge and experience of the Bartlett Tree Research Laboratories. When judged by results you will find the Bartlett Way—the scientific way, the safest and most economical.

Consult your Bartlett Tree Expert today. You will profit by his recommendations.

REMEMBER

Our long experience in working with both utilities and the public is your assurance of dependable work and good customer relations.

BARTLETT TREE EXPERTS

Home Office, Research Laboratories and Experimental Grounds, Bartlett School of Tree Surgery, Stamford, Conn. Local Offices from Maine to the Carolinas, and West to Indiana. See your Local Telephone Directory for Local Address.

This guy is growing fast!

Born just last year, the new Copperweld* Type M Guy Strand has become the fastest growing guy in the field. Men in the telephone, power, and railroad industries have helped it grow. They have welcomed Type M to their immediate family of products, and with it has come real economy. It sells at new low prices, thanks to Copperweld research and new production techniques. And it saves in yearly maintenance since Copperweld requires no upkeep—a fact long established.

Convenience is another quality of Type M. Pliable and easy to handle—it can be readily bent, served, moused or clamped. Write us today for complete information regarding the advantages of Type M and add it to your family of products now.

*Trademark

COPPERWELD STEEL COMPANY

WIRE AND CABLE DIVISION *Glassport, Pa.*

For Export: COPPERWELD STEEL INTERNATIONAL COMPANY, New York

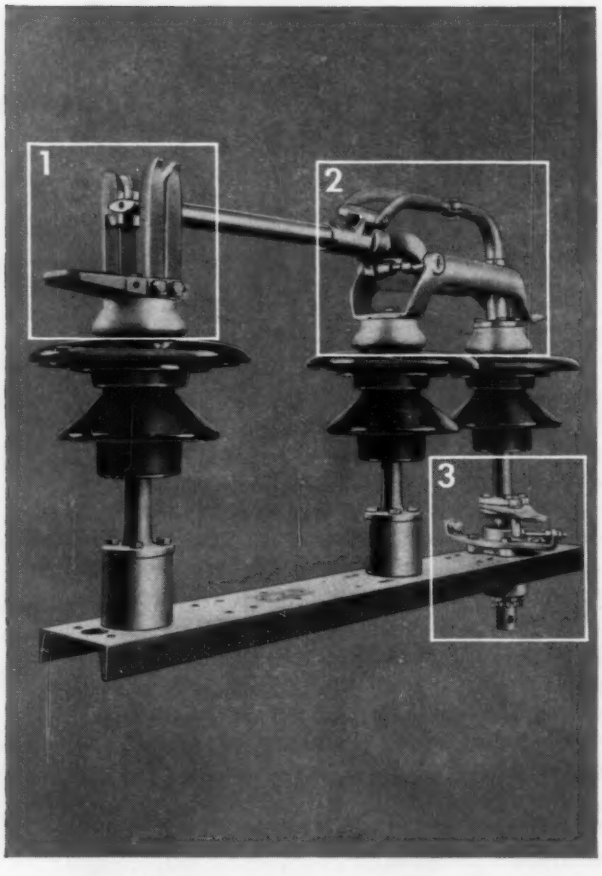
New Copperweld TRADE MARK

TYPE M GUY STRAND

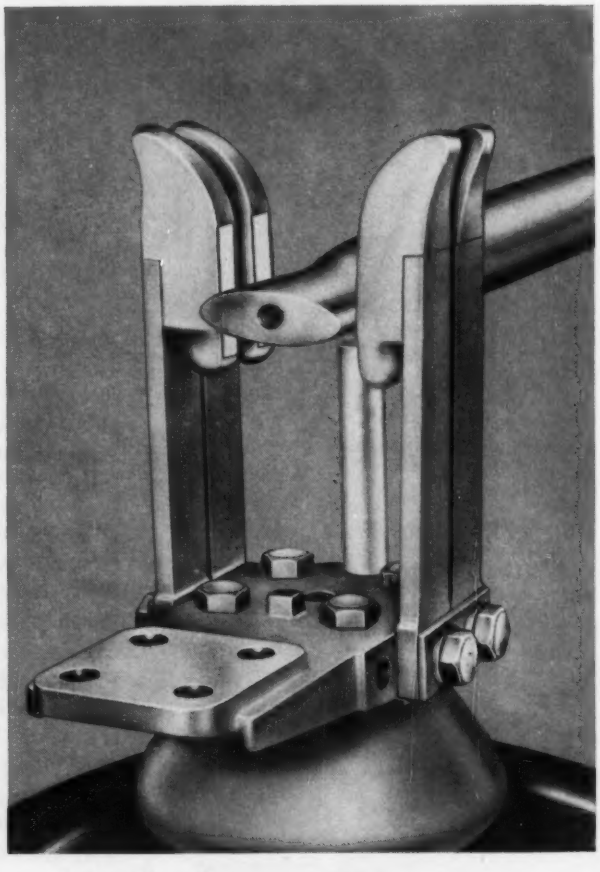
R&IE OUTDOOR DISCONNECTING SWITCHES

EASY TEST FOR

Look for these design features . . . they explain why



Look for rounded contours on all parts and liberal spacing between parts having relative motion. R&IE switches, designed this way, can be actuated under severe icing conditions with surprising ease. Other switches, with complicated or closely packed mechanisms, are generally handicapped by relatively thin ice coatings, locked by heavier ones.

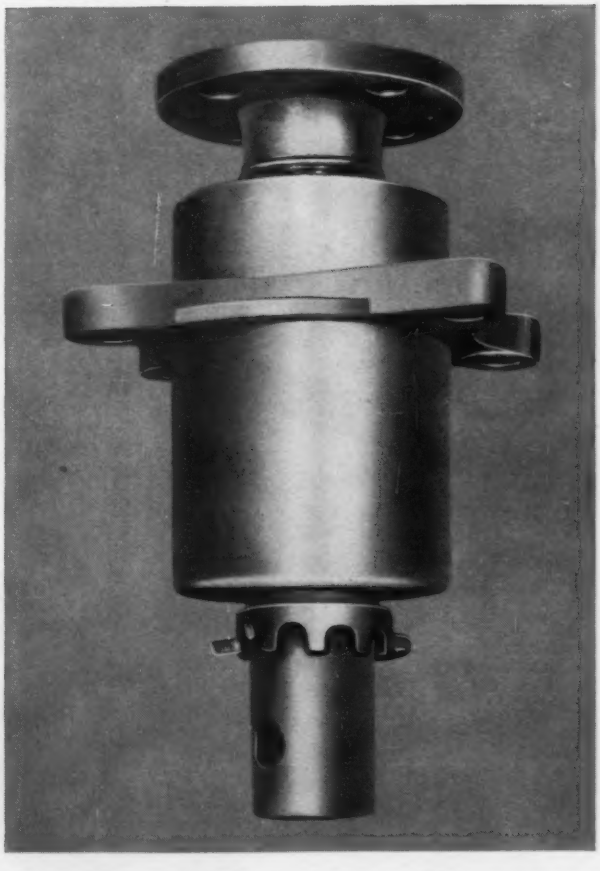


1 Look for heavy copper jaw fingers—silver-to-copper contacts. Thus constructed, R&IE switches show no evidence of overheating when tested well above their short-time current ratings. R&IE avoids the use of thin stamped jaws, which lack thermal capacity, often burn or erode under overload or fault currents . . . requiring more frequent maintenance.

Compare R&IE switches, point by point, with others. Discover the extra assurances of better performance, which you get at no extra cost. Available in ratings from 7.5 to 345 kv and from 400 to 6000 amp. For complete information, ask your nearby I-T-E sales office for a copy of Bulletin 1342-A. Or write R&IE Equipment Division, Greensburg, Pa. In Canada: Eastern Power Devices Ltd., Port Credit, Ont.

BETTER SWITCH DESIGN

you can expect better performance from R&IE switches



2 Look for sealed hinge-end contacts. R&IE switches have weather-sealed contacts at the hinge end for continuous low-resistance current transfer. Exposed hinge-end contacts are vulnerable to ice locking and, when corroded, lower short circuit capacity. Look also for only nonferrous exposed live switch parts . . . an R&IE feature which assures long switch life.

3 Look for a sealed, greaseless switch bearing. This part transmits turning force from the operating crank to the switch actuating mechanism. The R&IE switch bearing, sealed against moisture and foreign matter, is not affected by low temperature and requires no lubrication. Unsealed bearings are subject to fouling by ice and dirt, making switch actuation difficult or impossible.

I-T-E CIRCUIT BREAKER COMPANY
R & I E EQUIPMENT DIVISION • GREENSBURG, PA.

Neoprene

Houston Lighting

protects lead from electrolysis in & Power Company system

Electrolytic attack of the lead sheath on underground cable was once a problem for Houston Lighting & Power Company. Deterioration was severe in Galveston, where much of the underground cable lies in brackish water in sea-level manholes and runs. Even in the city of Houston, somewhat higher elevation and distance from salt water did not save lead-sheathed cable from damage.

Protective neoprene jackets hold promise of ending this problem. Many of the underground installations in the Houston Lighting & Power Company system are now jacketed with neoprene, and there have been no maintenance problems with it. The covering on all triplex service drops is also neoprene.

Neoprene's durability and its ability to save time and costs have gained wide acceptance among Distribution Engineers. No other jacketing material so effectively resists ozone, sunlight and weathering, oils and chemicals, heat, flex cracking, abrasion and cutting, oxidation and aging.

Ask your supplier about wire and cable jacketed with neoprene. And mail the coupon for copies of the ELASTOMERS NOTEBOOK with on-the-job reports of neoprene's performance in a wide range of jobs.

DU PONT
REG. U.S. PAT. OFF.

Better things for better living
. . . *through chemistry*

NEOPRENE
— made by Du Pont
for 26 years

E. I. du Pont de Nemours & Co. (Inc.)
Elastomer Chemicals Dept. EW-8
Wilmington 98, Delaware

Please put my name on the free mailing list for the ELASTOMERS NOTEBOOK.

Name_____
Position_____
Firm_____
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City_____ State_____

Part of the Permutit Precipitator-filter-demineralizer plant treating 2 million gallons of water per day at West Virginia Pulp & Paper Company, Charleston, S. C.

She's only five foot two, but she "operates" these six Permutit Valveless Filters

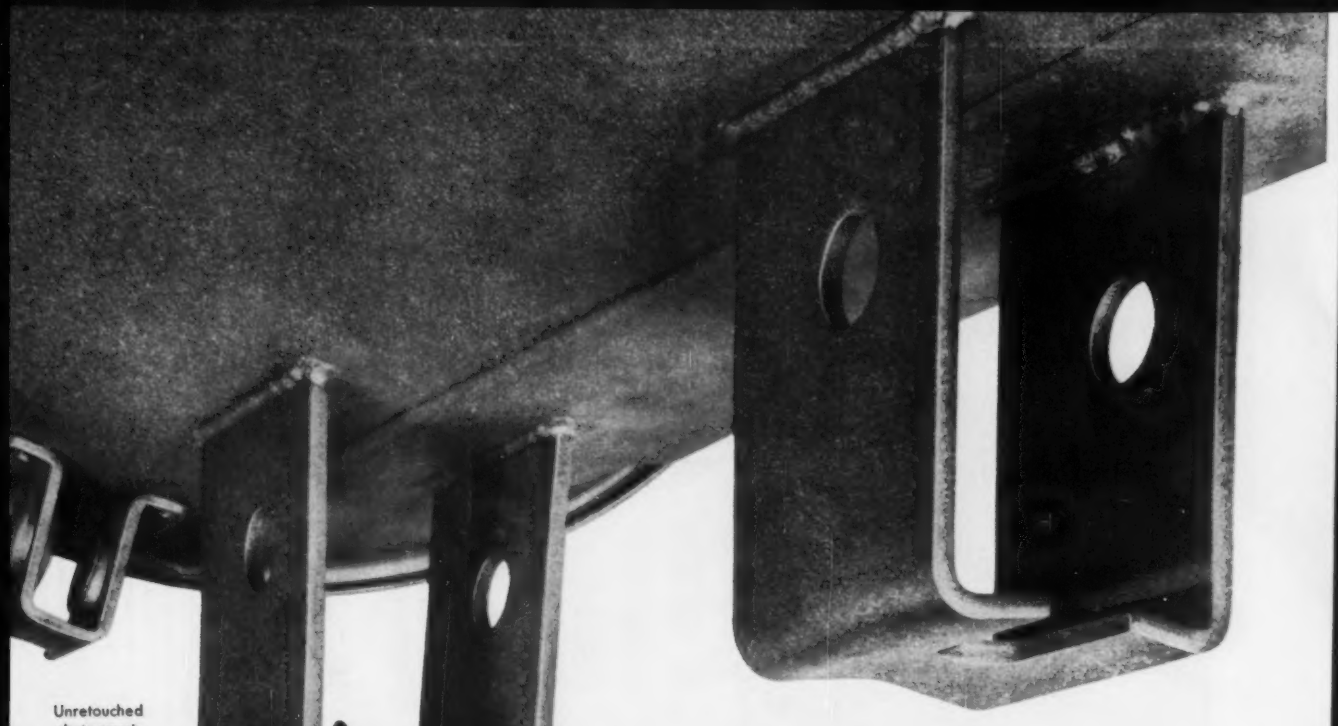
• If these were standard manually-operated gravity filters, it would take 3 husky well-trained men (3 one-man shifts) to open and close heavy valves for shutoff, backwash and rinse. If they were table-controlled automatic filters, the initial cost would be almost *doubled.*

Fact is these filters are in the same price range as manual filters, yet they are *completely automatic.* They shut themselves off from service at just the right bed condition. They backwash and rinse at the most efficient flow rates and for a pre-set length of time. Then they put themselves back into service. The little lady doesn't have to touch them!

Permutit Valveless Filters use a simple design employing basic hydraulic principles to do the "thinking" and the work . . . replacing expensive valves, flow controllers and hydraulic or pneumatic control systems. Initial installations have been approved for treatment of drinking water as well as process water.

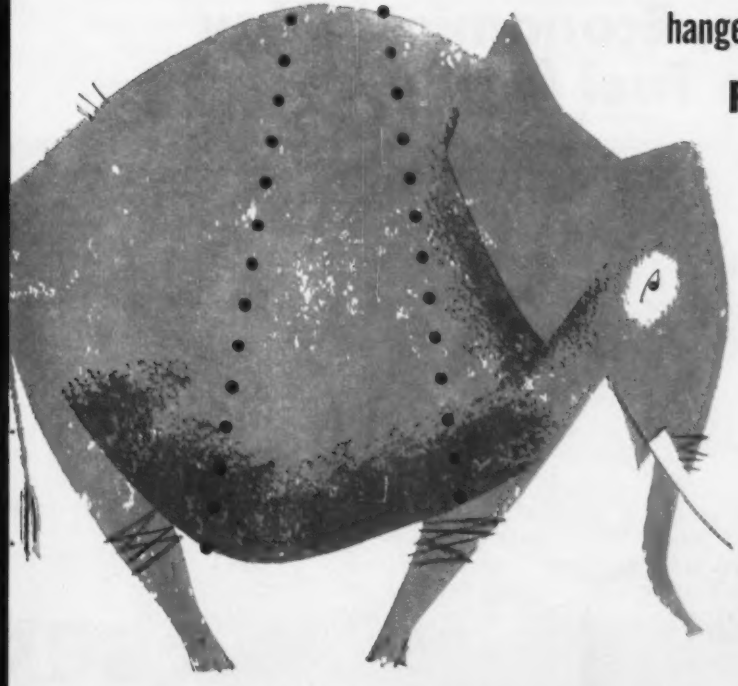
Our new Bulletin No. 4351 tells how you can cut both initial and operating costs with Valveless Filters. Call the nearest Permutit man or write to The Permutit Company, Dept. EW-8, 50 West 44th Street, New York 36, N. Y., or Permutit Company of Canada, Ltd., Toronto 1, Ontario.

PERMUTIT®
rhymes with "compute it"
a division of PFAUDLER PERMUTIT INC.
Water Conditioning
Ion Exchange • Industrial Waste Treatment



Unretouched photograph of shot-blasted, unpainted tank.

to keep the transformer on the pole . . .



hanger brackets of Pennsylvania **POLE STAR** distribution transformers are hand-welded completely around the bracket flange.

No crevices are left that might remain unpainted and where rust-producing moisture can collect.

McGRAW EDISON

PENNSYLVANIA TRANSFORMER DIVISION
McGraw-Edison Company • Canonsburg, Pa.

POLE STAR

HOW THESE INSTALLATIONS

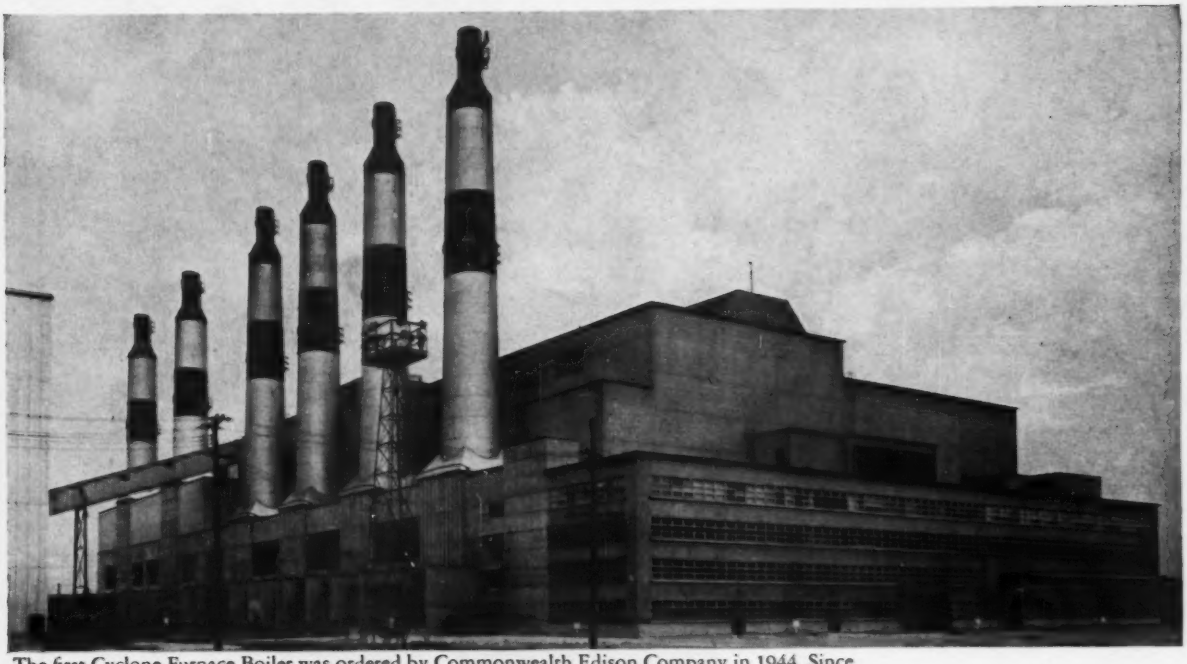
Jersey Central Power & Light Company's E. H. Werner Station. Here the success of the B&W Cyclone Furnace Boiler, the first installed in the East, has led to the purchase of two more boilers.

The B & W Cyclone Furnace...

A Modern, Economical Way to Burn Fuel for Power

Niles Station of Ohio Edison Company where two B&W Cyclone Furnace Boilers have been in operation since 1954.

UTILIZE LOW-GRADE FUELS



The first Cyclone Furnace Boiler was ordered by Commonwealth Edison Company in 1944. Since then this utility has purchased 15 more units, six of them for the Ridgeland Station shown here.

The B&W Cyclone Furnace simplifies the entire process of coal preparation, combustion, ash handling and ash segregation. Its cost-saving quality contributes to lower fuel costs and reduced maintenance as well as increased operational simplicity, flexibility and safety.

Although the B&W Cyclone Furnace operates simply and dependably on either oil or gas, it is particularly effective in utilizing inexpensive, low-grade coals. Its rapid combustion burns the coal more completely and operates with low excess air. Most of the ash is melted to slag right in the Cyclone Furnace, where it is easy to handle and dispose of. The slag cleaning and fly-ash problems so prevalent with other types of firing are consequently alleviated.

Many other modern advances in combustion and high-pressure, high-temperature steam generation are available through B&W. Write for further information today. The Babcock & Wilcox Company, Boiler Division, 161 East 42nd Street, New York 17, N. Y.

G-882

BABCOCK & WILCOX

BOILER DIVISION

PURCHASERS OF THE B&W CYCLONE FURNACE

FOR CENTRAL POWER STATIONS	Number of Cyclone Furnace Boilers
Atlantic City Electric Co.	1
Baltimore Gas & Electric Co.	1
Chilena de Electricidad	2
Columbus & Southern Ohio Electric Co.	2
Commonwealth Edison Co.	16
Consumers Public Power District (Nebraska)	1
Detroit Edison Co.	1
Indiana & Michigan Electric Co.	1
Jersey Central Power & Light Co.	3
Memphis Light, Gas & Water Division	3
Middle South Utilities, Inc.	1
Missouri Public Service Co.	1
Monongahela Power Co.	1
Northern Indiana Public Service Co.	3
Ohio Edison Co.	2
Ohio Power Co.	6
Public Service Co., of New Hampshire	1
Tampa Electric Co.	3
United Illuminating Co.	2
Wisconsin Power & Light Co.	4
FOR INDUSTRIAL INSTALLATIONS	
American Cyanamid Co.	1
American Enka Corp.	1
Columbia Southern Chemical Co.	1
Consolidated Water Power & Paper Co.	1
Dow Chemical Co.	5
Eastman Kodak Co.	1
Greenwood Mills	1
International Paper Co.	4
National Container Corp., of Wisconsin	1
Rhinelander Paper Co.	1
St. Croix Paper Co.	1
Thilmany Pulp & Paper Co.	1
West Virginia Pulp & Paper Co.	1
Total	**75**

I HAD THE BOSS UP A POLE...

"He knew all about the operating advantages of polyethylene coated wire . . . but I took him up and showed him why I liked it and why it's saving the company even more money than he figured."

In the past 12 years polyethylene covered line wire and cable have chalked up outstanding service records for utilities. But some of the best reasons for using polyethylene coatings don't turn up in operating statistics — they come from the men whose job it is to install and maintain the lines . . . Reasons such as these:

Polyethylene Is Easier to Install

It's free stripping, yet has excellent adhesion and will not ruffle over cross arms. It's clean to work with and its surface is "slippery" too. Polyethylene coating is lighter than other types of covering . . . it handles easier.

Polyethylene Covered Line Wire Saves Outages

Polyethylene forms a complete and permanent covering over line wire. That means fewer outages from contact with trees, wind-blown swinging wires and foreign objects. Smaller diameter polyethylene coatings offer less wind resistance above ground. Lighter weight can be an advantage, too, in ice storms.

In field servicing . . . in over-all performance and service life—polyethylene has proved its superiority in wire and cable applications such as these:

- Line wire covering
- Power cable dielectric
- Tree wire covering
- GTO (Neon Sign) Cable
- Coaxial Cable
- WD-1 Infantry Field Wire
- Control cable insulation and jacket
- Communication cable insulation and sheaths
- Corrosion protection for metal sheaths.
- TV Lead Wire

When you order polyethylene covered wire and cable, ask your supplier about the superior weather and stress crack resistance of polyethylene made with PETROTHENE® polyethylene resins. PETROTHENE quality costs no more.

U.S.I. INDUSTRIAL CHEMICALS CO.
Division of National Distillers and Chemical Corp.
99 Park Ave., New York 16, N. Y.
Branches in principal cities

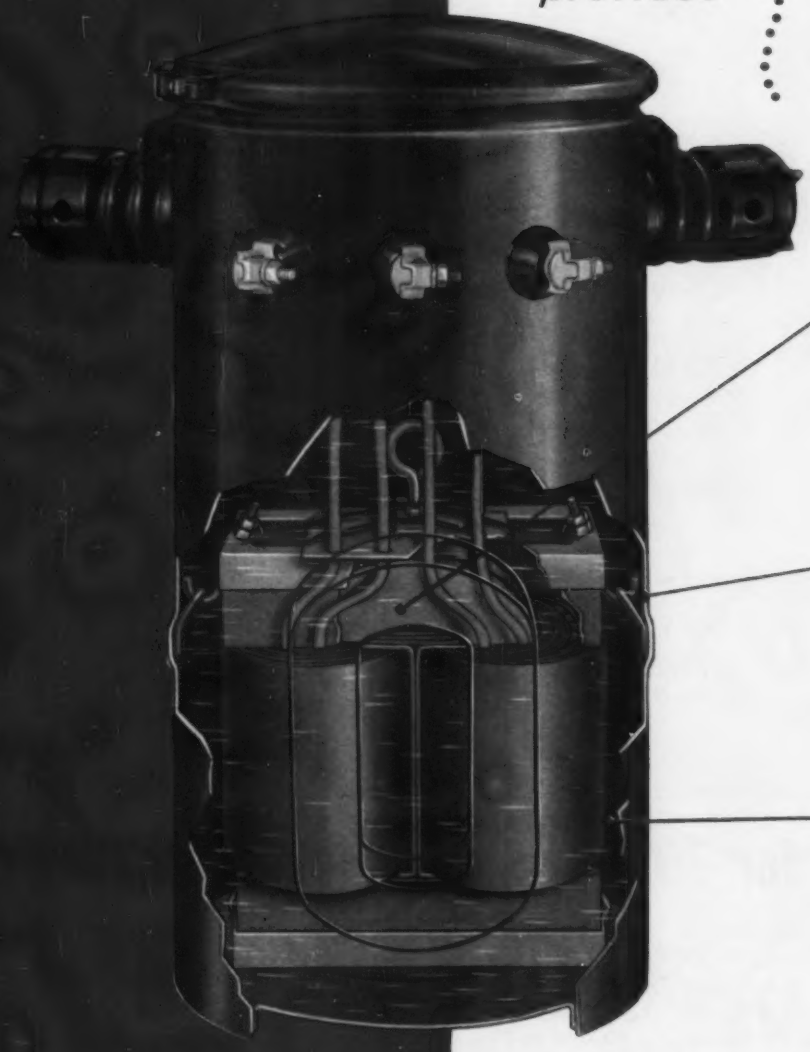
Makers of PETROTHENE Polyethylene Resins

RT&E

engineering talent concentrated on transformer CORE development

provides

- **Lower Core Loss**
- **Uniform Performance Characteristics**
- **Quieter Operation**
- **Easier Repairability**
- **Lighter Weight**



The R T & E wound core represents the newest innovation in core construction in over 20 years. It is constructed of the finest grain-oriented steel available, formed into a compact core of single turn laminations with butted joints. It has set new standards for lower core losses, quietness of operation, uniformity of performance and easier repairability.

Two "J" bolts fasten the assembly securely to tank wall and exert a downward pull on the upper core clamp. The compressive force produced clamps the full-span coil blocks firmly against the coil sections for added short circuit strength.

The unique R T & E method of fastening the core-coil assembly in the transformer tank eliminates the need for conventional side braces by utilizing the tank wall for this purpose. Elimination of these side braces exposes more coil surface to the oil, and provides an unobstructed path for oil circulation through the coil ventilating ducts.

ENGINEERING TALENT CONCENTRATED ON ONE IDEA
A BETTER TRANSFORMER

RT&E CORPORATION

WAUKESHA, WISCONSIN • PORTLAND, OREGON

EXPANSION JOINTS

Drinking heavily for 30 years and still healthy

This U. S. Rubber Expansion Joint has been drinking brackish sea water (at temperatures from 50 to 100 degrees F.) for three decades. It and another identical 36" U. S. Rubber Expansion Joint are at work on the intake lines of #5 condenser at the Reeves Avenue Power Station of the Virginia Electric & Power Company in Norfolk, Virginia, where they compensate for the vibration, expansion and contraction caused by pumping the sea water. These are two of the first rubber expansion joints ever installed *anywhere.*

U. S. Rubber Expansion Joints are the economical, flexible connections that are used in all kinds of pipe lines to take care of misalignment, vibration, expansion and contraction, and noise transmission. They have no moving parts to wear or bind. They can be installed on both new and old piping and equipment.

When you think of rubber, think of your "U. S." Distributor. He's your best on-the-spot source of technical aid, quick delivery and quality industrial rubber products.

Mechanical Goods Division

United States Rubber

WORLD'S LARGEST MANUFACTURER OF INDUSTRIAL RUBBER PRODUCTS

Rockefeller Center, New York 20, N.Y. In Canada: Dominion Rubber Company, Ltd.

CAPACITY! CONTINUED IMPROVEMENT!

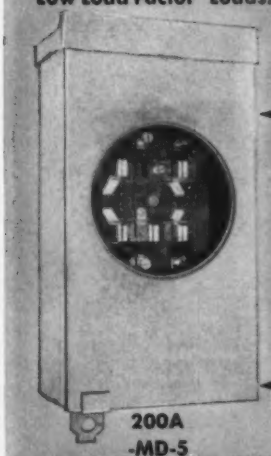
DUNCAN

METERS AND MOUNTING DEVICES

—up to 200 amperes of service capacity using Self-Contained Extended Range Meters

TYPE MD

Now "High Capacity" with reinforced jaws. Particularly applicable for 200 amp. service on residential or other "Low Load Factor" Loads.

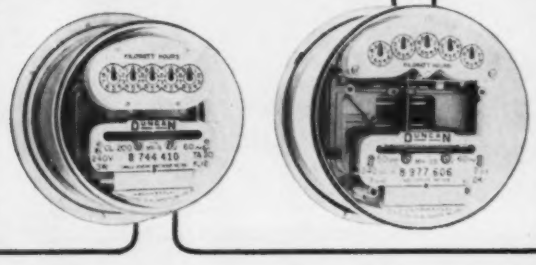


200A -MD-5

TYPE HD

for "High Demand, High Load Factor" Loads.

200A -HD-5

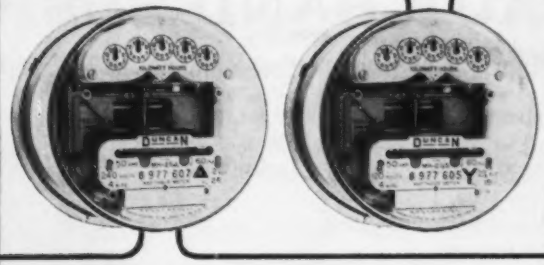


MD Companion Devices for the **CLASS 200** meter —pioneered by Duncan **HD**

175A -MD-7

200A -HD-7

All HD and MD Devices have arrangements for manual by-passing.



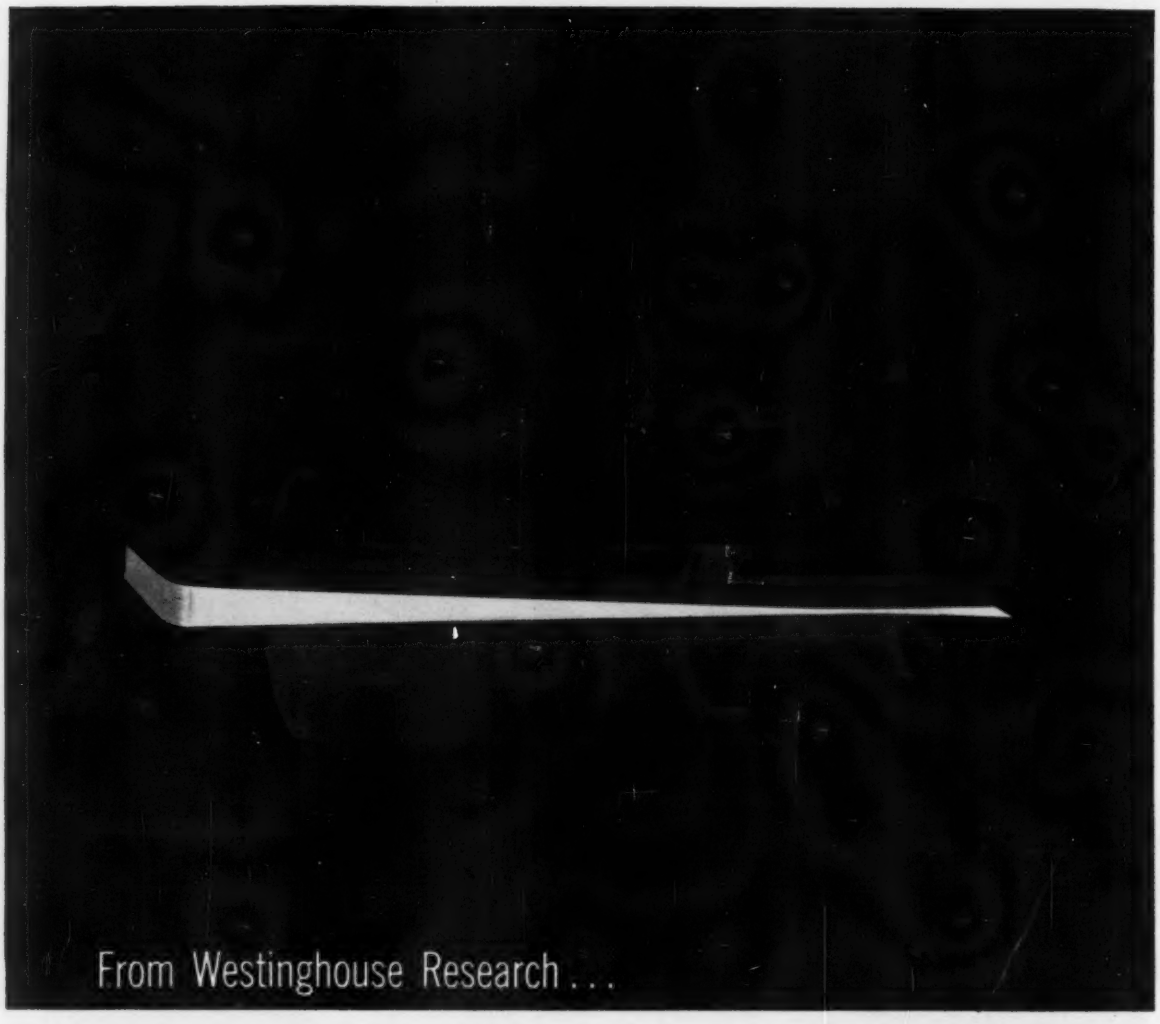
DESIGNED FOR THE SERVICE

for TOP ECONOMY

for MAXIMUM CAPACITY

LIVE BETTER ELECTRICALLY WITH FULL HOUSEPOWER

DUNCAN ELECTRIC COMPANY LAFAYETTE, INDIANA



NEW TAUT BAND SUSPENSION

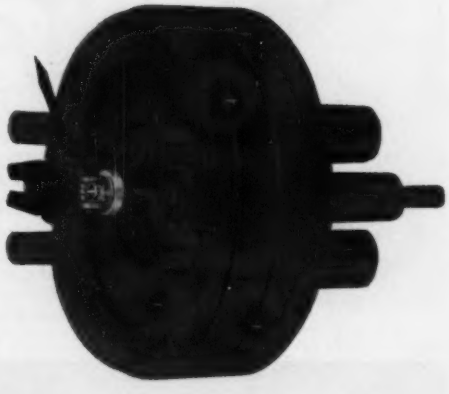
One of the most important instrument developments of the century!

A tough metal band about one-tenth the thickness of a human hair is the heart of the amazing Taut Band Suspension system developed by Westinghouse Instrument Engineers.

- Eliminates all pivot and bearing friction with instruments mounted in any position.
- Accuracy unaffected by severe vibration and shock.
- Eliminates maintenance from damaged pivots and bearings.
- Increases sensitivity.

Try them and compare.

Call your Westinghouse sales engineer today for complete details about the superior features of Taut Band Suspension, or write Westinghouse Electric Corp., P. O. Box 868, Pittsburgh 30, Pennsylvania. J-40519



YOU CAN BE SURE...IF IT'S Westinghouse

AFTER 12 WEEKS' TEST: Untreated Wood. Severe fungus attack completely covers wood block resulting in disintegration and loss of weight.

Pressure-Creosoted Wood. Fungus all around but none on the test block. No disintegration—no loss of weight.

We feed fungus—so you can starve it

Pressure-creosoted utility pole removed after 22 years in the ground and still in excellent condition. No sign of rot, no fungus growth and no termite attack.

Fungus thrives on untreated poles buried in moist, warm earth . . . but it can't stand creosote. To find out the most effective way to protect utility poles, United States Steel conducts continuous research on the likes and dislikes of various fungi.

Results have been startling. In a 12-week test, untreated wood blocks exposed to fungus attack took on weird shapes and suffered a heavy loss of weight. In contrast, pressure-creosoted wood resisted the attack and kept its shape and weight.

Pressure creosoting not only stops fungus growth, it repels termite attack, and plain rot, too. In most areas, pressure-creosoted poles last from 25 to 35 years. Where else can you get such low-cost insurance?

For more information on the advantages and economies of pressure treatment and USS Creosote—the quality preservative—write United States Steel, 525 William Penn Place, Pittsburgh 30, Pa., or call our nearest chemical sales office. Pressure-creosoted poles are available from treaters in most parts of the country. U. S. Steel supplies only the creosote.

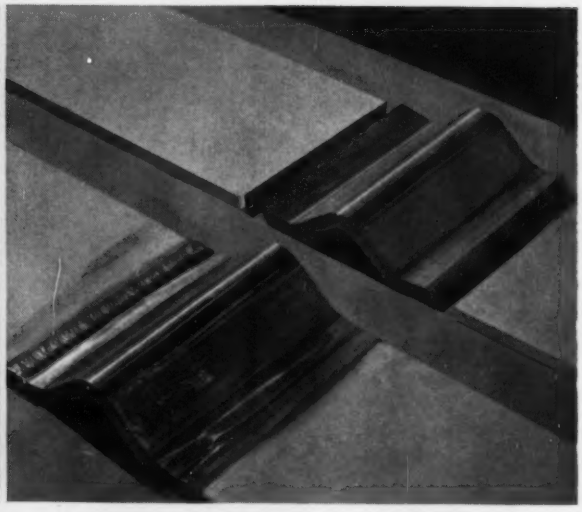
"Creosote's past assures wood's future!"

Sales Offices in Pittsburgh, New York, Chicago, Salt Lake City and Fairfield, Alabama

USS Creosote

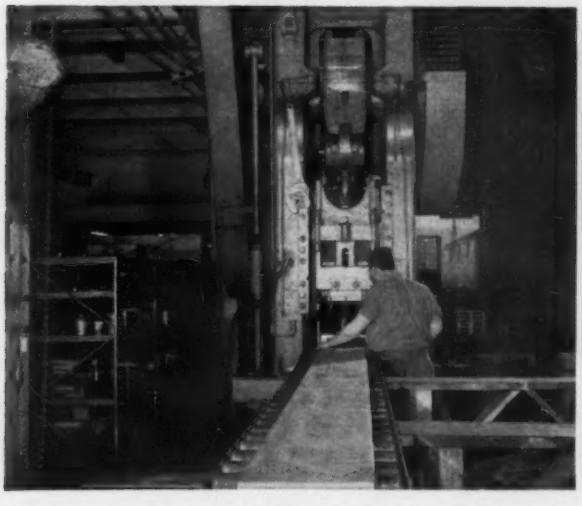
TRADEMARK

WELDING— No blistering of plating in the weld area



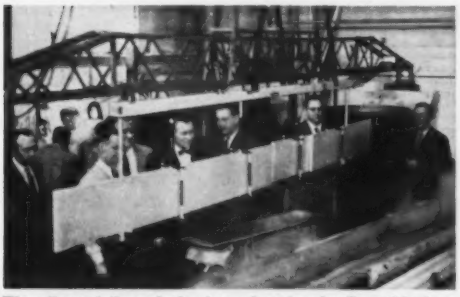
FORMING— No breaking or peeling around bends

PUNCHING— No fraying or chipping around edges of punched holes



R&IE fabricates REYNOLDS New Silver Plated Bus Bar with ease

Punching, Forming And Welding Operations Performed After Plating With Positive Results



The silver plating of aluminum bus bar by Reynolds is a factory process designed and controlled to provide the quality of plating required.

I-T-E Circuit Breaker Company's, R & IE Division at Greenburg, Pennsylvania has put their fabricating know-how to work on Reynolds new Silver Plated Aluminum Bus Bar with significant results. Their techniques and the characteristics of the Reynolds product assure economy and efficiency in bus systems.

Photographs on the facing page show how R & IE performs various fabricating operations on plated bus bar for an extensive bus system to be used in a large electro-chemical installation. Note that the aluminum bus bar is punched, formed and welded without damage to the plated surface. There is no fraying or chipping around the edges of the punched holes . . . no breaking or peeling at bends . . . no blistering of the plating in the weld areas.

Reynolds Silver Plated Aluminum Bus Bar was used for three important reasons:

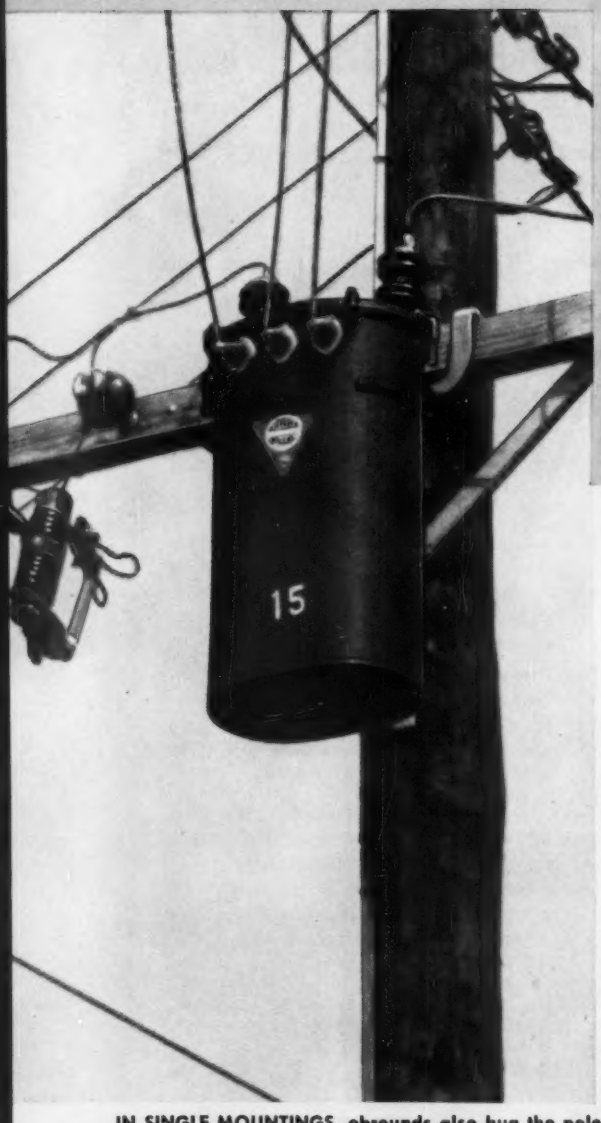
1. **Plated aluminum bar is lower in cost than equivalent copper bar.**
2. **Plating provides for simple, inexpensive, reliable electrical connections.**
3. **Reynolds is the first commercially available plated aluminum bar with established quality standards.**

And, now, R & IE also knows that this plated bus bar can be fabricated by their time and labor saving techniques without damage to the plated bar. It is possible to produce high quality aluminum bus bar systems for large installations quickly, effectively and economically.

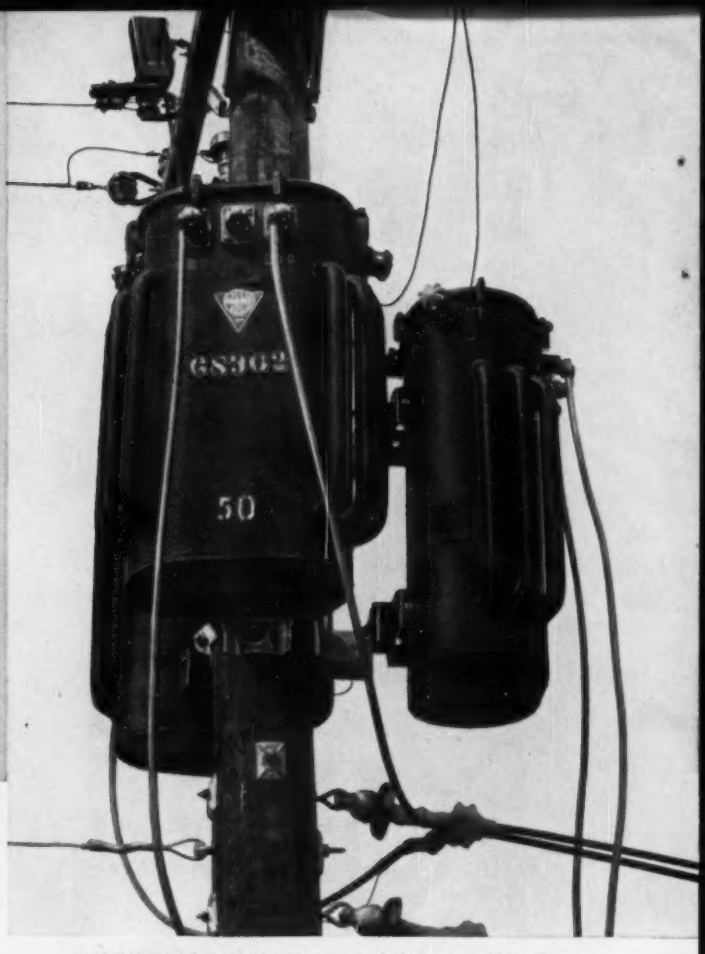
For details and availability data write today for new brochure, "Reynolds Silver Plated Aluminum Bus Conductors", *Reynolds Metals Company, P. O. Box 2346-EL, Richmond 18, Virginia.* For assistance from Reynolds Engineering Service call your nearest Reynolds office or write to the above address.

REYNOLDS ALUMINUM

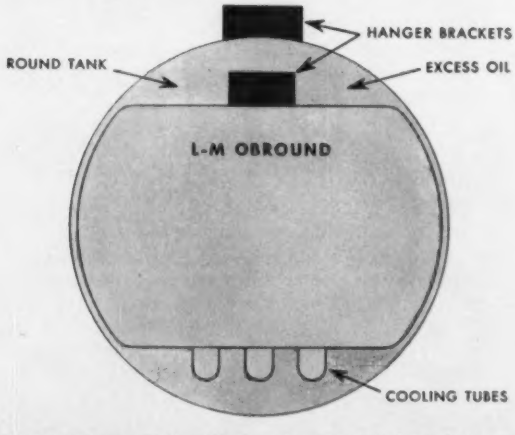
Watch Reynolds All-Family Television Program "DISNEYLAND", ABC-TV.



IN SINGLE MOUNTINGS, obrounds also hug the pole, cutting bending moment and providing a very neat-looking installation, as shown in this photo of an L-M Round-Wound transformer on the lines of Public Service Company of Indiana, Inc., in a new subdivision north of Plainfield.



ANOTHER VIEW of the obround cluster-mounting, showing the accessibility of bushings and convenient arrangement for the linemen. These obround transformers may be hung on any standard cluster-mounting bracket, and spacing may be adjusted as desired.



DRAWING shows the difference in size and shape between a standard round tank and the L-M obround transformer. The obround has less oil, and tubes provide ample cooling. The lighter, more compact obround hugs the pole, reducing bending moment on the pole.

PHOTOS BY
A. T. BELLER

LINE MATERIAL Industries
McGRAW-EDISON COMPANY

THREE CLUSTER-MOUNTED 50 kva 2400 volt L-M obround transformers serving a large hospital at Lafayette, on the Public Service Company of Indiana, Inc., system. The neat appearance and the convenience for linemen which the L-M obround shape offers, and the economy, performance, and long life of the L-M-exclusive Round-Wound construction are ideal for this type of installation.

Public Service Company of Indiana, Inc., Likes Neat Appearance of L-M "Obrounds"

Compactness and light weight make obround transformers easier to hang, provide more climbing space, improve pole appearance, and give highly efficient performance.

Hundreds of utility men have selected L-M obround transformers because of their compact shape, and because the performance of the L-M-exclusive Round-Wound® design is still outstanding in load capacity and economical operation.

Public Service Company of Indiana, Inc., has installed a sizable number of L-M obround transformers, in both cluster and single mountings. Among the many desirable features found in the obround design were its neat appearance, the fact that it provides ample, safe climbing space, and the good acceptance of this transformer by the linemen.

In cluster mountings, the use of the obround offers a substantial saving in material and labor over a standard two-pole platform installation. Wiring costs are substantially lower, particularly on the 167 kva units.

"In fact," one company engineer stated, "with the obround we can practically put a whole substation on one pole! This is particularly advantageous in temporary locations such as those in the Indiana Limestone quarrying areas, where stations must be moved to serve moving quarry operations."

The obround transformer goes up easily between secondary wires. In working on a single transformer or a cluster, the lineman has ample working space, and he doesn't need to extend his safety belt too far to reach the bushings. And, despite the compact shape and light weight, the obround still gives the outstanding load capacity and high efficiency for which the L-M Round-Wound core-coil construction is so well known.

Find Out About L-M Obrounds

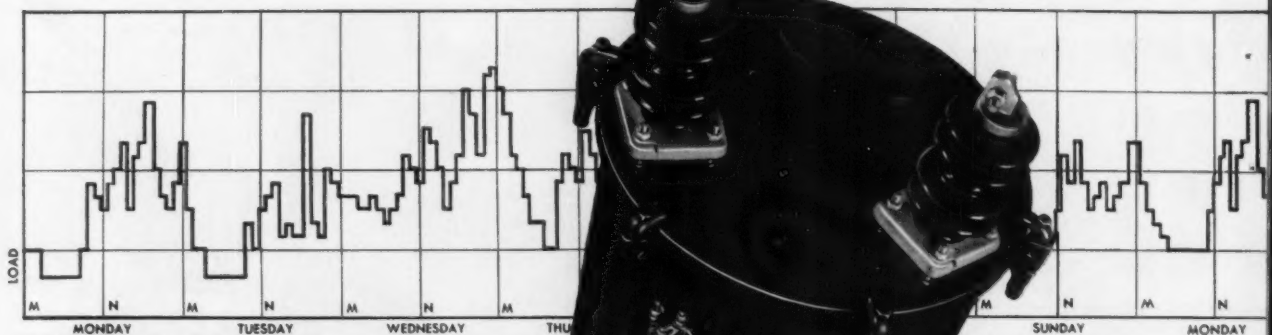
L-M Round-Wound construction offers many advantages: high short-time overload capacity; low losses; balanced performance. The obround shape puts the frosting on the cake! Ask the L-M field engineer for facts and figures; or write for bulletins to Line Material Industries, Transformer Div., Zanesville, Ohio.

Distribution Transformers

McGRAW EDISON

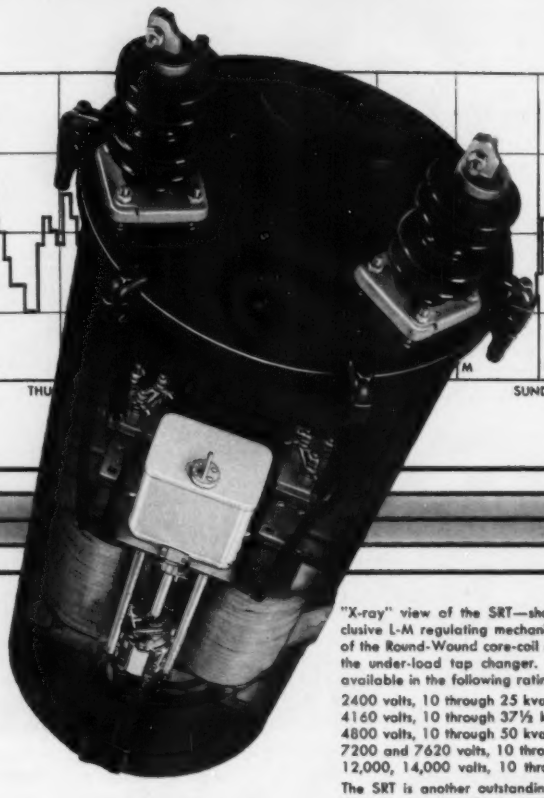
341

DISTRIBUTION TRANSFORMERS • KYLE RECLOSERS AND OIL SWITCHES • FUSE CUTOUTS AND FUSE LINKS • LIGHTNING ARRESTERS • POWER SWITCHING EQUIPMENT
PACKAGED SUBSTATIONS • CAPACITORS • REGULATORS • OUTDOOR LIGHTING • LINE CONSTRUCTION MATERIALS • PORCELAIN INSULATORS • FIBRE PIPE AND CONDUIT



Actual utility company load curve on a transformer for an August week.

With SRT, voltage would have been kept within the band width (blue lines)



"X-ray" view of the SRT—showing the exclusive L-M regulating mechanism at the top of the Round-Wound core-coil assembly, and the under-load tap changer. SRT's will be available in the following ratings:

2400 volts, 10 through 25 kva
4160 volts, 10 through 37½ kva
4800 volts, 10 through 50 kva
7200 and 7620 volts, 10 through 75 kva
12,000, 14,000 volts, 10 through 100 kva

The SRT is another outstanding engineering development of the Thomas A. Edison Laboratories of McGraw-Edison Company.

HERE is L-M's New SRT the World's First Self-Regulating distribution Transformer

Provides regulation at the point of use; corrects overvoltage and undervoltage in four 2½% steps; improves utility company revenue and provides better service for utility customers.

By **ROBERT P. THOMPSON**
Manager of Engineering, Transformers
Line Material Industries

The new L-M Self-Regulating distribution Transformer should make an outstanding contribution to profitable, economical utility operation. By providing regulation *at the point of use*, the SRT improves revenue by avoiding loss in billings caused by *undervoltage;* and it gives customers better service by more efficient operation of lights, appliances, and all other electrical devices. By preventing *overvoltage*, it reduces burnouts of lamps and television tubes.

L-M Round-Wound Design

The SRT is basically a Round-Wound® transformer with extra taps on the *primary*, and an under-load tap changer. The voltage regulating mechanism is volt-sensitive on the *secondary*, so voltage is maintained within a 3½-volt band width centered around 120 volts.

"Adapt-A-Tap" Range Selector

The "Adapt-A-Tap" range selector provides a full 20% range within which the taps for the 10% automatic regulation may be selected—all below, straddle, or all above normal. Thus the SRT may be located anywhere on the line—at the end, in the middle, or near the substation. Four 2½% steps are provided. Operation occurs only after a time delay to prevent undesirable operation and "hunting" on switching surges and momentary voltage changes outside the band width.

More Economical Regulation

The SRT provides extremely economical regulation, *at the point of use*, and it opens wider horizons to the distribution system design engineer for more effective system planning.

Sold For Test Program

The limited initial production of SRT's will be sold to utility companies who wish to make thorough tests of the possibilities of this revolutionary new engineering development. These tests should enable utilities to determine the extent to which SRT's may be applied, and the best methods of application.

Ask The L-M Field Engineer

For details about the SRT, ask the L-M Field Engineer who calls on your company; or write A. R. Waehner, Director of Transformer Sales, Line Material Industries, Milwaukee 1.

LINE MATERIAL Industries
McGRAW-EDISON COMPANY
Distribution Transformers

McGRAW EDISON

Editorial Comment

AUGUST 4, 1958

The ECAP Tax Ruling: Only the Beginning?

The Internal Revenue Service ruling which disallows ECAP advertising expenditures for tax purposes is a matter on which we clearly stated our position in the June 16th issue. We said then, "It behooves us . . . to stand up and resist this ruling in every fair and legal manner possible . . ." If, as an industry, we do not stand up, if we fail by default, then we have helped clear the field for the Ellises and the Kefauvers to set up and attack their next targets.

And what might these targets be? Let's examine a few . . .

If advertising expenditures can be disallowed on the ground that they support what has been called ". . . propaganda, pure and simple . . .", how long will it be when, say, the travel and hotel expenses of a utility executive going somewhere to deliver a speech on the same subject will be given similar tax treatment? Or for that matter, his salary during the time he prepares and delivers his speech, or his secretary's time in typing it?

Consider the variety of other expenditures which, in one way or another, could be interpreted as "propagandistic": A company's membership in the Public Information Program could come under attack . . . as could its support of, say, the U. S. Chamber of Commerce, an organization assuredly not given to adulation of the Kefauver-Ellis position.

One could go on ad infinitum, but it is not necessary. The point is already obvious. Not only is this ruling manifestly unfair, and probably unconstitutional, but it opens the door to an endless series of abuses and discriminations that cannot help but seriously damage the private companies' capacity to fulfill their public service obligation, and with it, the social and economic fabric of this country's democracy. The ECAP ruling may be only the beginning.

The Time to Sell Automation

In times of lagging business activity, the manager faces his crucial test. He can trim costs, pull in his horns, and hope for better days ahead. Or he can plan to integrate long-range efficiencies in his operations, develop new products and new markets, and spark a more aggressive selling program.

Smart managers are aware of these and are open minded to suggestions all along the line. For the first time in a decade they have enough slack in production to begin thinking about increased efficiency and lower-cost operations for busier times ahead. It is a situation made to order for installing more automation in many production plants.

And this is where the utility comes in, for automation is the key to expanded use of electric power in industry.

C. A. Tatum, Jr., president of Dallas Power & Light Co, has suggested that "we should fully organize our own people who know something about automation and send them into the plants on our systems with an agressive program for modernization." This would be a start.

But the utilities which have a large market potential for expanded automation might want to go further. They should consider hiring more industrial engineers with specialized experience in automation for their power sales staff. This would enable them to exploit a market that is made brighter by the business slump.

EIGHT INCHES of snow was not unusual on many circuits during storm

"Worst" Storm Damage

- **Exclusive report on March snowstorm tells why storm-tested systems suffered damage exceeding $10 million**
- **Changes in designs include stronger static wires for transmission; elimination of wood pins, reappraisal of guying practices, and use of stronger poles in distribution**

The last day of winter, March 20, brought a blizzard of wet, heavy snow that swirled northeastward out of Virginia. It went through Maryland, Delaware, Pennsylvania, across New Jersey and Long Island, and touched parts of New England. Burdened by reported radial thicknesses up to 5 in., transmission and distribution facilities began to fail until an estimated 1.6 million electric customers were blacked out.

This was the most destructive storm ever experienced by eastern utilities. Estimates of the cost of repairing the damage initially ran to $10 million. The ultimate cost will exceed this by a significant amount.

Why did overhead lines which had bested many previous storms, including howling winds and snow, sleet, and a number of hurricanes, suffer such damage? This report, gained by interviewing design and operating engineers, tells why the failures occurred, what they were, and what can be done to further "stormproof" overhead facilities.

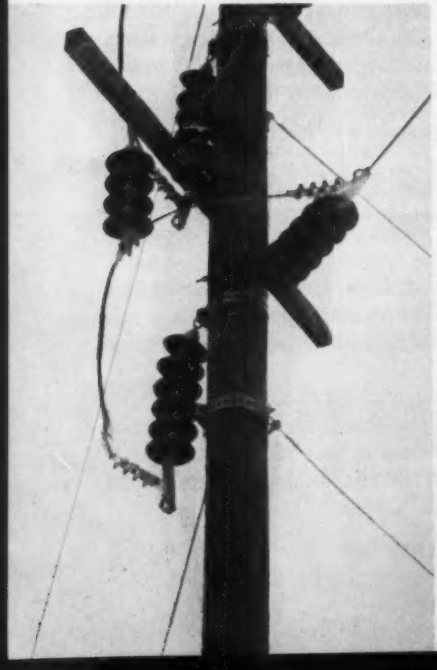
The main cause was the temperature, which hovered near the freezing point throughout the storm. The resulting wet snow was reported to weigh up to 34 lb per cu ft, about five times more than ordinary snow. Light to high winds, with gusts, also were reported. Overhead lines in the area affected are designed to ½ in. of radial ice and an 8-lb wind, backed up by design for vertical loading of 2 in. of ice and no wind.

Failures thus were due to mechanical overloads on conductors, static wires, guys and structures, which led to direct damage and progressive failure of lines in many cases. Stresses on steel towers were calculated to be up to 3½ times greater than design loads. Secondly, failures occurred upon the release of tremendous energy when the heavy snow load fell suddenly from conductors. A rapid series of these impact loadings, as snow fell from adjacent spans, led to damage of many sections of line.

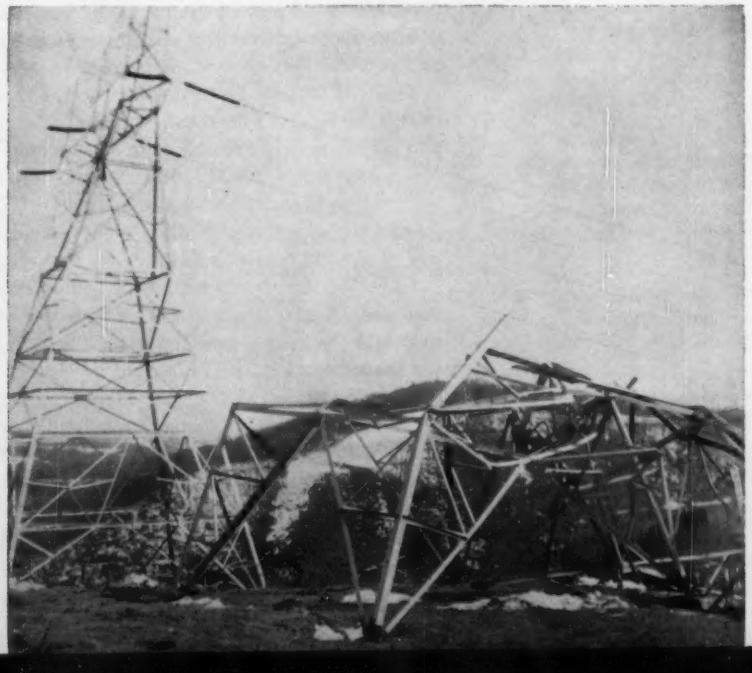
Reporting on transmission line damage, four companies said they had failures when oversagged static wires contacted phase conductors which had dropped their snow loads. Also reported were mechanical breaks in static and phase conductors.

On a 115-kv two-circuit river crossing, the lines came down when the insulator support failed after the ACSR conductor "birdcaged." In this and cases of conductor breaks reported by one company, there was evidence of galloping conductors. Damage to towers consisted of a smaller number of crumpled towers,

BIRDCAGING OF ACSR conductor was reported by a number of companies



RIVER-CROSSING SPAN of stronger conductors pulled down weaker 230-kv towers. Utilities will study "weak link" to prevent tower or conductor damage



Will Bring Changes in T&D Design

and a larger number of failures in the region of the crossarms. In river crossings involving 66-kv, 110-kv, and 220-kv circuits (built by a predecessor company), the steel towers proved to be "weak links" as they were dragged to the ground by disproportionately stronger conductors.

A 115-kv H-frame line built in 1956 was destroyed for 2½ miles (22 structures). This single-circuit line consisted of Class 2 and 3 creosoted SYP poles and Class 4 creosoted SYP arms carrying 336.4-MCM 26/7-strand ACSR and ⅜ in. HS 7-strand steel static wires. It is believed that birdcaging of middle and outside phase conductors at one terminal triggered the failure.

Damage to hardware included failure of static wire and phase wire suspension clamps when the load deadened at that point; pullout of tower strain plates; breakage of insulators at the ball shank with strings in cantilever; and failure of suspension strain clamps due to improper installation.

ISOLATED SECTIONS of well-built circuits were destroyed for a mile or more at a stretch. Moving vehicles may have contacted services laden with snow

SOME OPEN-WIRE SERVICES did stay up; generally, services gave all utilities plenty of trouble. Triplex services performed much better than did open-wire

Design Changes Studied

To further stormproof transmission lines, the companies will:

1. Strengthen certain members in tower arms and legs to increase vertical-load capability (applies generally to older towers).

2. Study tower-conductor combination "weak link" so overloaded conductors will drop before they break or tower is overstressed.

3. Set up test spans (one company) to study galloping conductors.

4. Shorten longer spans (up to 1,300 ft) with intermediate structures.

5. Use a larger safety factor in static wires on older lines by reducing normal tension from 25% to 15% of ultimate strength (standard for newer lines). Size and material for stronger static wires also are being studied.

6. Move static wires inboard to increase present 1.5-ft horizontal separation of phase wires (vertical configuration) to 4-5 ft (double-circuit 66-kv tension towers).

7. Lengthen middle crossarm on steel towers to increase horizontal separation of phase wires (vertical configuration) to 5 ft.

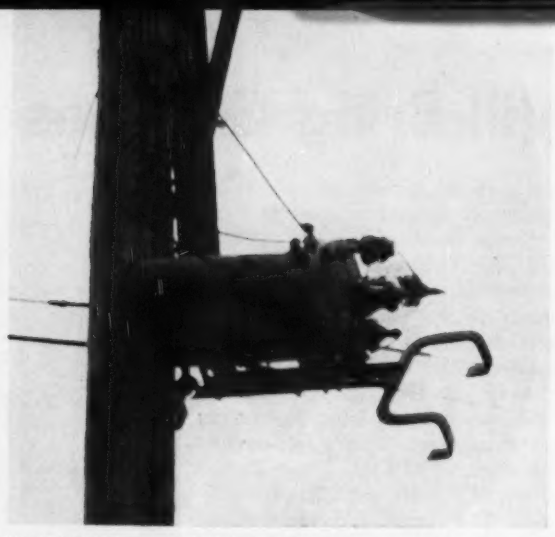
8. Design tower footings with special attention to soil conditions at the tower sites.

9. Study application of sleet melting and detection equipment (one company).

10. Use nothing smaller than Class 2 pole for 33 kv and above (one company).

In reporting distribution damage, companies said thousands of wood poles were damaged or destroyed

GUYING DESIGN will come in for close attention as one means of strengthening circuits against heavy storms



"ANY NUMBER OF TRANSFORMERS jumped off the crossarms", one utility said. Fewer pole-mounted units fell

by bending, twisting, or compression column action, or a combination of these forces. There was no indication of a relation between number of poles broken, or type or location of the break, and age, class, treatment, or species of poles. One company noted poles generally were broken 20-35% of the way down from the top, where stress was concentrated from the transverse wind load due to attachments and guying. At heavy deadends and heavy corners, poles rather than crossarms broke.

However, thousands of crossarms were broken by mechanical overload or impact loading. Arms also were sheared or split as load built up on wood pins. One company reported that wood pin failures were not too great; another said "great numbers" of pins were broken, popped out of, or pushed into crossarms. Steel pins were bent; crossarms with steel pins appeared to fare better than arms with wood pins.

Distribution conductor breaks and burndowns were estimated at well over 100,000. Smaller copper conductors broke; aluminum conductor of equivalent current-carrying-capacity held, with the result that poles were snapped. No. 4 copper or equivalent, used as a minimum size by a number of companies, performed satisfactorily; No. 4 ACSR for street lighting performed well. Conductors 2/0 and larger generally held, but supporting poles were broken. It was reported that sag on some ACSR did not return to design levels following the storm; birdcaging of ACSR also was a big problem. One company reported galloping conductors on distribution circuits.

Two companies found failures of mechanical line splices, while two noted satisfactory performance of this type of splice. Trouble apparently was due to the wire necking down within the splice and then failing. One company had "any number of transformers jump off the crossarms, either one or both hangers." Pole-mounted transformers stayed up in considerably greater numbers.

Another company said that no triplex services failed, while others reported that triplex experienced fewer breaks than did open-wire services, which came down by the thousands. However, triplex loaded up sufficiently to pull out service attachments, and parts of the house in some cases. Aerial cable installations were not affected by the storm; one utility reported that expanding anchors pulled out.

Will Strengthen Lines

To strengthen distribution circuits, these measures are being considered:

1. Increase the minimum size conductor in all construction to larger than No. 6. One company may use a larger pole, as any increase in conductor size (No. 4 now minimum) would pull present poles down. A higher class pole is proposed for joint-use construction by another company; a third will minimize the number of holes drilled in wood poles.

2. Greater use of double-arming on highway and straight construction.

3. Elimination of wood pins (three companies) and elimination of mechanical line splices (two companies) in favor of improved compression splices. Also, eliminate deadending of small conductors on pin insulators.

4. Reappraisal of guying practices, particularly for three-phase vertical configuration at deadends, corners or tangent poles. Possible changes include attachment of guys at the same height at which conductors are attached; longer lead length and taking of column loading into account in all guying design; more lateral guying; and standardization on heavy guy wire.

5. Increase use of underground getaways from distribution substations.

6. Stress-strain curves for greater than ½% elongation of conductors need to be developed.

7. Use of more primary and secondary aerial cable.

8. Elimination of series street lighting circuits in favor of multiple systems.

9. Investigation of the possibility that services across main roads were pulled down by high vehicles.

10. A possible "weak link" in the first span away from wood pole substations to save structures from being pulled down.

FPC Stepping Up Downstream Benefit Study

The Federal Power Commission is stepping up its investigations to try to put a dollar value on "downstream power benefits" which power dams may get from upstream river-control reservoirs.

This type of benefit—also called a "headwater benefit"—is based on any increase in the power dam's output or generating capacity, which is the direct result of increased flows created by an upstream reservoir.

The major push for these FPC studies is coming from new federal multi-purpose dams built in river basins above existing private and other non-federal power dams. Section 10 (F) of the Federal Power Act requires all private or non-federal power dams to pay upstream federal or FPC-licensed dams for such benefits, as determined by the FPC staff.

Benefit charges are figured retroactively in order to get exact assessments, and the commission hopes to repeat these studies about every two years for each river basin involved.

Briefly, charges for downstream benefits are determined by totaling the actual amount of power produced at a specific dam (where an upstream multi-purpose dam has been operating), subtracting from that figure the amount of power that would have been generated from normal stream flows had no upstream dam been operating, and multiplying the difference by an appropriate sales value.

In cases where an upstream reservoir benefits more than one power site below it, the benefit charges would be apportioned. However, if a federal dam is benefitted by an upstream multi-purpose reservoir, no payments are required by law, even though the FPC staff has determined that benefits do exist.

An FPC-supported bill before Congress—which has no chance of passage—would require federal dams to pay benefit charges to upstream reservoirs, righting the present "one-way street" whereby federal dams may collect benefit charges from downstream private and non-federal dams, but pay nothing themselves to upstream dams.

Two types of power benefits are being hunted in these reviews: **1.** Direct increase of power generated. **2.** An increase in dependable hydro-generating capacity.

The first is the only type of benefit found in completed studies, as increased dependable capacity has been virtually impossible to prove in areas where hydro facilities are used primarily for peaking service.

An upcoming study of the entire Columbia River basin—the most complex study foreseen by the FPC—may turn up evidence of added dependable capacity, since a greater percentage of hydro plants in the Pacific Northwest are used for dependable capacity.

There are 35 basins eligible for FPC review besides those shown above. Within this total of 48 basins —where studies either have been completed, are underway, or are pending—there are 89 federal and 32 non-federal multi-purpose dams upstream which may be benefitting 23 federal, 253 non-federal dams downstream.

How FPC assessed power benefits in four river basins . . .

River Basin	Upstream Dam	Downstream Power Dam Benefitted	Benefit Charges Assessed
San Joaquin	Southern Calif. Ed.	Pacific G&E	% payments agreed on, ok'd by FPC
Alabama-Coosa	Allatoona*	Alabama Pwr Co	$76,000 ('50–52) 156,000 ('53–55)
Clarion	East Branch*	Penn. Elec	8,000 ('53–55)
Columbia	Montana Pwr	Rock Island (Chelan PUD, Puget Sound P&L)	27,000 ('52–53) 20,000 (1954)

. . . and these basins are under study

River Basin	Upstream Dam	Downstream Power Dams
Columbia	Grand Coulee, Hungry Horse, Albany Falls, etc.**	Wash. Water Pwr, Idaho Pwr, Montana Pwr, etc.**
Quachia	Blakely Mtn*	Arkansas P&L
Chattahoochee	Buford*	Georgia Pwr
Missouri	Canyon Ferry*	Montana Pwr
Savannah	Clark Hill*	S.C. E&G
Kern	Isabella*	Pacific G&E, Southern Calif. Ed
Roanoke	Philpott*, John Kerr*	Virginia E&P
Willamette	Seven federal dams	Portland Gen Elec, Pacific P&L

* Federal ** Federal and private

Outage Again Hits Middle South System

Trouble originating at a new unit of Louisiana Power & Light Co's Sterlington steam plant for the second time in recent weeks contributed to an outage over portions of the Middle South Utilities system. A tripout of the 210-Mw unit at LP&L's plant separated the system and led to blacked-out sections of northern Louisiana, Mississippi Power & Light Co's areas in and around Jackson, Natchez and Vicksburg, and Arkansas Power & Light Co's southern territory. Substantially the same areas were out during trouble on June 17.

Duration of last fortnight's outage varied from about five to 45 min, said LP&L Pres W. O. Turner. Load for the area involved was about 500 Mw while total system load was about 1,800 Mw, he said.

"For reasons unknown . . . the system separated so that other ample spinning reserve could not pick up the load dropped at the time of the outage," Turner explained. Studies are under way to determine the cause and sequence of both system interruptions.

U. S. Power Picture

- Peaks are shifting to summer at a faster clip
- Simulated A-bomb attack finds inventory slack
- 12.5-Mw geothermal unit planned by Pacific G&E

• The shift from winter to summer system peaks is occurring at a stepped-up pace, according to a study released last week by Middle West Service Co of Chicago. Pegged to the growing use of air conditioning, the swing by 1962 will find utilities representing 69% of the total industry power load having summer peaks, the consulting firm predicts.

Colorado, Michigan and Wisconsin by 1965 are expected to join 28 other states where the majority of peak loads occur in the summer. These 31 states will contain about 82% of the total electric customers, Middle West forecasts. "By 1965, utilities representing approximately 75% of the total industry load will have summer system peaks," the report states.

Based on replies representing about 89% of customers in the U.S., the study reveals "that utilities are shifting from winter to summer peaks at a faster rate than was indicated in our 1955 survey." In that study, Middle West predicted the majority of the peak loads by 1965 would occur in the summer in 30 states on utility systems with 71% of the total industry load.

Three years ago, utilities representing 24% of total industry load had hot weather peaks. This rose to about 30% in 1956 and 45% in 1957. Last year the majority of the utilities' peak loads in 19 states occurred in the summer, Middle West says, compared with only six states in 1950.

Winter peaks are expected to continue in Florida and Tennessee because of space heating, the report notes.

• A simulated atomic attack on the U. S. May 6 and 7—when 275 enemy "bombs" were dropped—produced evidence electric utilities' material inventories are inadequate for repairs that would have to be made to restore service.

The assumed attack was part of the nation's fifth annual Civil Defense exercise. The Interior Department reports 76% of the private utilities it checked made a "good showing in figuring the effects of such bomb and radioactive fallout damage on power loads, facilities, material and personnel. Participating utilities spent 18,400 man-hours in figuring effects of the "attack," considerably more than was spent on the 1957 exercise.

The 1958 tests are divided in three parts: Phase one involved repair work by individual utilities after the May 6-7 attack; phase two (July 14-18) involved work by utility representatives at regional and national Civil Defense headquarters on utility problems requiring federal aid; the final phase (Sept. 15-17) will be devoted to an over-all evaluation of the 1958 exercise.

31 States to Have Majority of Peaks in Summer By 1965

• Plans to produce electric power from the natural steam of geysers have been disclosed by Pacific Gas & Electric Co. It has signed a letter of intent with Magma Power Co, Los Angeles, and Thermal Power Co of San Francisco. Thermal Power is leaseholder of geyser property near Healdsburg, Calif., north of San Francisco (EW, Apr. 1, 1957, p 42).

After the contract is signed, PG&E will seek California commission authorization to install a 12,500-kw generating plant at Big Sulphur Creek. Additional units are contemplated if the first installation proves successful and sufficient new steam wells are produced. Initial PG&E cost to produce and transmit the power will be about $2 million.

Magma and Thermal will pipe the steam to the plant turbine at a pressure of 100 psi and a temperature of 348F, supplying 265,000 lb of steam per hour.

Washington Wire

- Push begins on TVA bill
- Fryingpan clears hurdle

• The House Public Works Committee has approved another Tennessee Valley Authority bond financing bill—this time the Senate-passed Kerr bill with several restrictions. Supporters hope to push the measure through the House by the end of the present session.

Late last year the committee approved the more liberal Jones-Davis bill, but supporters became aware that such legislation—minus

federal controls on service area or total indebtedness—would never be approved. The Kerr bill replaces the Jones-Davis bill as the committee's choice in a last ditch try at House approval.

Committee action on the Kerr bill came last week after several days of suddenly called hearings. About 30 congressmen, power company leaders, and Chamber of Commerce spokesmen took turns blasting provisions of the measure.

Pres Philip Sporn of American Electric Power Co predicted the bill's enactment would "permit, and indeed, invite expansion of TVA's service area into an additional area of some 25,000 square miles . . ."

Pres R. B. Wilson, Mississippi Power & Light Co, said it would unnecessarily strengthen TVA at a time when his company is "having a life and death struggle" with a rural cooperative, "supplied by subsidized TVA power," to keep the co-op from taking "an entire [three-county] area away from us."

W. L. Bayfield, executive vice president of the American Coal Sales Association, testified against the possible TVA expansion because, "The coal-buying policies of the TVA are the most ruinous and deflationary that could be conceived. They have . . . made a mockery of the Walsh-Healey Act."

• The controversial Fryingpan-Arkansas reclamation-power project cleared one more hurdle two weeks ago in Congress, but the bill to authorize its construction still may not cross the wire before the present session adjourns.

The House Interior Committee, by a 19-4 vote, approved the $160-million project July 23, but the committee's report on the bill may not be completed until Aug. 1. This would crowd the bill into a last-minute log-jam in the House Rules Committee, where it may be buried.

The bill, passed by the Senate in June, 1957, calls for diversion of water from the western slope (Colorado River basin) of the Continental Divide into the eastern slope for irrigation, reclamation and power projects on the Arkansas River within Colorado. Diversion would be made in agreement with existing Colorado River compacts and with the Colorado River treaty with Mexico. The project would include seven power dams with a total of 104,800 kw installed capacity.

Legislation to authorize such a propect has been enacted three times by the Senate, but on two previous occasions the House has failed to take any action.

Small Unit Holds Promise for India

This pilot unit of an electric generator and pump may bring marked benefits to India's tiny villages in which four-fifths of the country's people live. The device is run by bullocks whose plodding about the fulcrum in one direction produces 4½ kw; when reversed they pump enough water to meet the needs of the villagers and irrigate 100 acres.

Developed under the joint auspices of the Ford Foundation and the Indian Community Development Ministry, the unit stems from research by C. Leigh Stevens, who heads a large Maryland industrial-engineering firm that bears his name. The device was developed with the cooperation of General Electric Co, and the Tennessee Gas Transmission Co. It was first tested at Prairie View College, a small Negro school in Texas. Tracy Park, above, of Nashville, Tenn., is one of the American engineers participating in the project.

The small unit, a counterpart to the Delco power units seen on a few farms years ago, is expected to help establish small village industry. Production cost for the pilot device was $5,000 but full scale production should lower this to $3,000. Field tests will continue to iron out operating problems.

Atomic Progress

• Amity, but not 'til '59

• Despite the new atmosphere of amity, the Atomic Energy Commission and the Joint Committee on Atomic Energy are not expected to agree formally on a long-range program of civilian power reactor development before next year.

The Democratic-run committee may issue anytime a staff memorandum outlining a five to seven-year program for 1-million kw of new nuclear capacity to be built by industry and government.

The AEC majority goes along with most of it. But official sanction will be withheld at least until after industry has an opportunity to comment sometime in the fall.

BRIEFS: John A. McCone, new AEC chief, faces tough restaffing job in addition to gaining know-how on his new post. Five key staff people have resigned in recent weeks. They are Kenneth E. Fields, general manager; Richard W. Cook, deputy general manager; Kenneth Davis, director, reactor development division; and Louis H. Roddis and Clark D. Goodman, aides of Davis.

Rates and Regulation

• B. C. bid trimmed

• The Canadian federal government recently disallowed provisions for future income tax liability as a company expense in cases affecting the Bell Telephone Co and Canadian Pacific Railway. In authorizing an 8.54% rate increase for British Columbia Electric Co, however, the Public Utilities Commission did not disallow the provision.

The power company had sought a 12.18% boost. On the residential schedule, this would have provided an additional $2,940,000 in yearly revenue, but the PUC decision trimmed off $855,000. No increase is proposed in the lowest block of home rates, PUC said.

BRIEFS: Pennsylvania Power & Light Co has been ordered to begin a $3,623,000 refund, plus interest, to 600,000 residential and commercial customers by Oct. 1. The order stems from a 1956 PUC decision calling for a $6,320,000 refund to all classes of users. A subsequent court ruling denied claims by industrial users that they should have received the entire amount.

A 26.8% rate increase sought by Ohio Power Co for power sold to the village of Wellington has started a move by the city to get back into the generating business. . . . Allocation of frequencies to non-government services in the 25 to 890-mc spectrum (Docket 11997) will be the subject of an FCC hearing soon after Oct. 1 deadline for outlines on proposed evidence.

Public Relations

• Fallout sensitivity

• PUD shake-up under way

• "Destructive testing" is the term used to describe Atomic Power Development Associates' check on sodium water reactions which might occur in the Enrico Fermi Atomic Power Plant. Last month a test in a Trenton, Mich., quarry exposed a small residential area to a cloud of slightly alkaline—but not radioactive—smoke.

The fallout was "actually insignificant, but sensitive press-wise," said Detroit Edison Co's Dave Reed. "The thing occurred on a dull day so, naturally, the papers gave it a good play. We followed up immediately with a statement of explanation by Alfred Amorosi [APDA technical director], which had a satisfactory effect."

Deploring the public's "general lack of understanding" about the purposes of destructive testing, Reed said people are too inclined to draw the wrong conclusions. Continuing explanations, therefore, are necessary in projects linked to atomic power, he added.

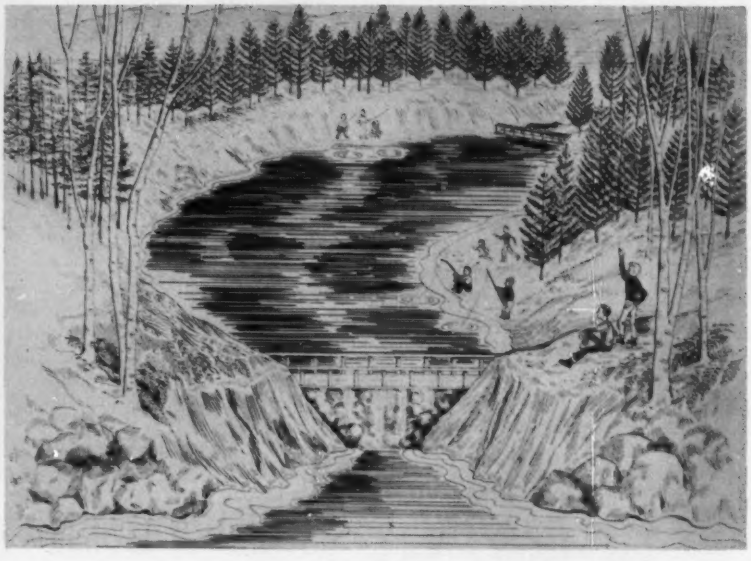
The fallout incident stemmed from a test to establish what would happen if a tube in the plant's steam generator ruptured. Five children reportedly were treated for chemical burns and several small claims for car damage have been filed.

• Grant County Public Utility District dismissed its two attorneys and then accepted the offered resignation of Mgr Glenn Smothers. Nat Washington and James Wickwire, the lawyers, were dismissed by a two-to-one vote after Washington issued a letter accusing Smothers of irregularities and violating state law in awarding contracts.

The PUD put Robert Ries, chief engineer, in charge of power production, Asst Mgr Evertt Gibbons, distribution and Darrel Ries, attorney.

At least one Grange group in the county had asked for the manager's dismissal and for a "legal investigation" of the PUD's affairs.

Ephrata and Quincy church groups previously had asked for grand jury action. Smothers came in for publicity earlier this year when a woman was killed in his hotel suite during a vacation party.



Output at 'Small Fry' Dam Is Good Will

Not for power, not for floods, just for kids. This is the label that will go on Oregon's newest and smallest dam.

Portland General Electric Co's Small Fry Dam, built on a creek running through a PGE recreational area to its North Fork project reservoir, will form a one-acre fishing lake. It will be stocked with legal-sized trout and only half-pint Isaak Waltons, 13 years and under, will be allowed to fish there.

A 13-ft high, rock-filled wooden crib structure, Small Fry has an overflow spillway topped by a footbridge. Total cost of the project was $5,000.

46-Kv Reclosers Improve Service Economically

Single-pole type sectionalizes, switches load, improves continuity; 3-pole type betters voltage level, kvar flow

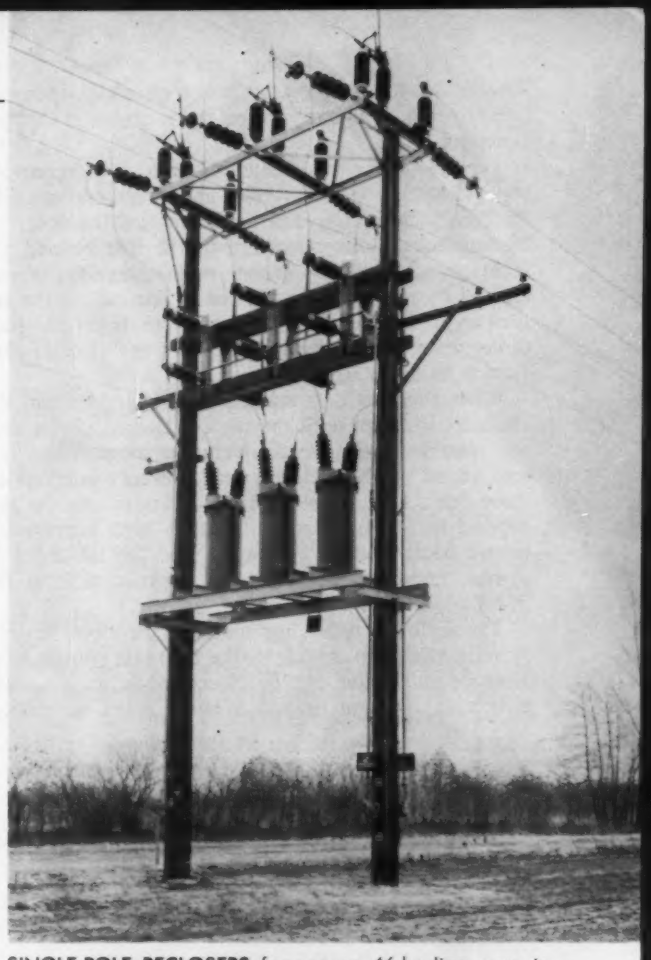
C. R. FRENCH, System Planning Engineer, General Engineering Department, Consumers Power Co, Jackson, Mich.

Reclosers switch Consumers Power Co's 46-kv subtransmission system which for several years, through the accumulation of new loads, has tended to take on the characteristics of a distribution system. The subtransmission system consists of several thousand miles of overhead lines. Some lines connect transmission substations as closed looped lines, but are normally open at some point. Others operate as radial lines of considerable length, serving important distribution substations.

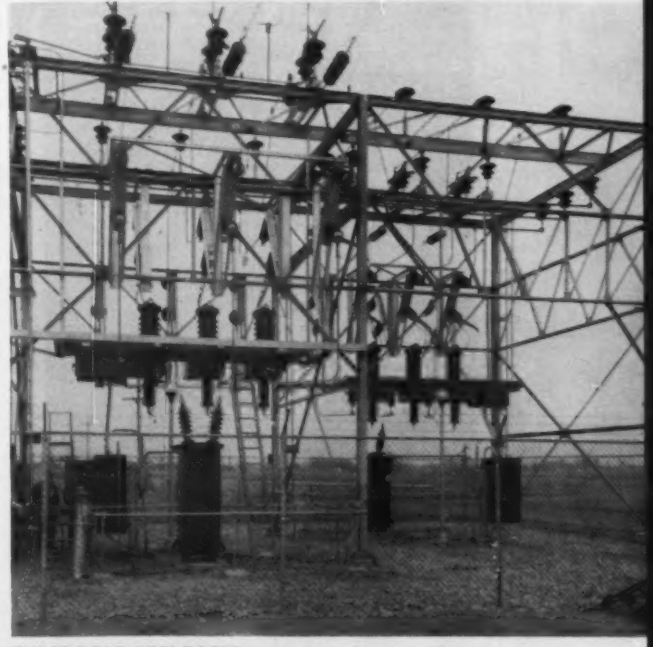
To improve service on this system at minimum cost, the 46-kv recloser was conceived. Single-pole and 3-pole units were then developed by the company with the cooperation of two manufacturers. These reclosers permit the closing of normally open lines and the sectionalizing of radial ones. The self-contained, single-pole recloser has a control and operating mechanism which receives and translates its own information. It performs according to time-current curves in an operating sequence which was set before the unit was installed.

The time-current characteristic is inverse, and operation covers a range of 280 to 3,600 amp, depending on the rating of the series coil and its accompanying pick-up value of fault current. The series coil can be wound for 140, 200, 280, or 400 amp, with a normal pick-up value of 200% which can be adjusted to 160% of rating. Each ampere rating requires a particular operating coil. The curves show that an instantaneous operation occurs, followed by the required preset time-delay operations. Lockout occurs after the final time-delay operation.

Single-pole, 46-kv reclosers are at Lambertville Junction and Clayton Junction. Lambertville reclosers coordinate with relays at Whiting steam plant, the point of generation. The circuit breaker at Whiting has step-distance relays for phase overcurrent protection, and directional ground relays with instantaneous-trip attachments. In the arrangement for each



SINGLE-POLE RECLOSERS for use on 46-kv line were installed on wood-pole structure at Lambertville Junction sub



THREE-POLE RECLOSERS went into Quincy substation, into steel structures previously built at the station

installation, the reclosers by-pass a normally open air-break switch. Rod gaps protect the reclosers at Clayton Junction.

The Lambertville installation was for improving service to the Lambertville and Temperance substations, particularly, and to the rest of the area, including substations connected to the line beyond the recloser installation. When momentary faults are cleared by the reclosers, service is restored to the entire area. Before the reclosers were installed, such faults were cleared by the breakers at Whiting, area service being interrupted.

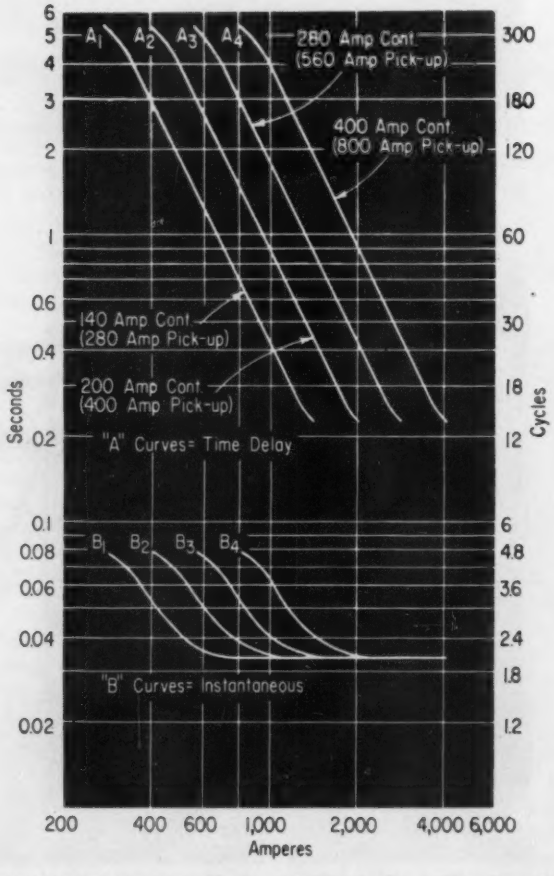
When there is a permanent fault beyond them, the reclosers lock out until the fault is cleared. Then they are reset manually. Such operation protects the system ahead of the reclosers and prevents interruption there due to a fault beyond the reclosers. As the line beyond is 14 miles long and has a high interruption record because of its age, type, and the incidence of storms, improvement in service is expected from the installation.

The reclosers make line maintenance more flexible. A normally open switch to the alternate source from Beecher substation can be closed while an air-break switch in the line toward Whiting plant is opened. Such temporary line switching formerly took a change in the relay setting at Beecher substation to coordinate the breaker there with other area devices. The reclosers now coordinate.

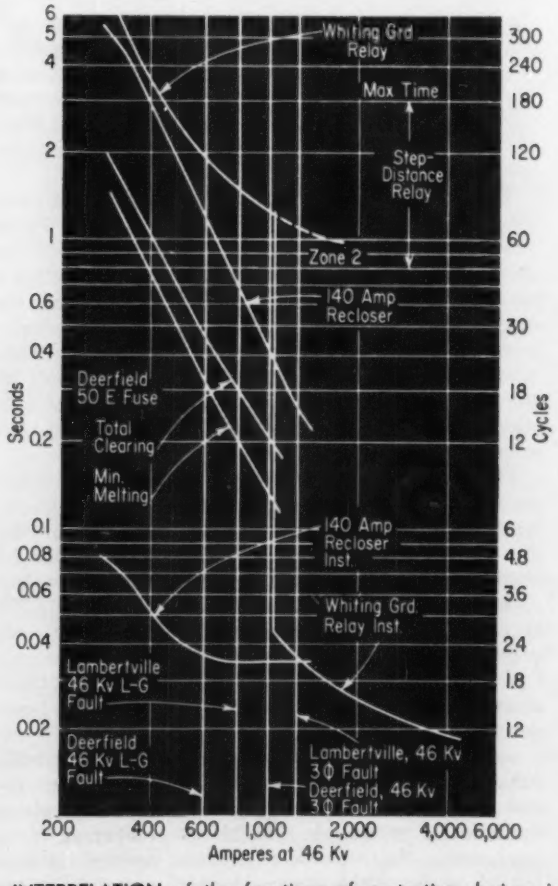
The function of each protective device is related to those of other devices as shown in the time-current characteristic curves for reclosers at Lambertville Junction, breaker relays at Whiting, and primary fuses at Deerfield substation. Good selectivity has been obtained. The only lack of selectivity in this sequence is the conflict between instantaneous operations of relays and reclosers. This conflict causes no difficulty, both instantaneous operations being completed in a number of cycles acceptable in such a distribution system.

Reclosers at Lambertville are on a wood-pole structure. Such structures are economical to build and maintain, and can, in most instances, be installed directly in the line right-of-way. Coordination of the single-pole recloser installation at Clayton Junction with other system elements resembles that at Lambertville. This installation is at ground level and is enclosed by a fence. Service records, it is hoped, will help determine any need for surge protection.

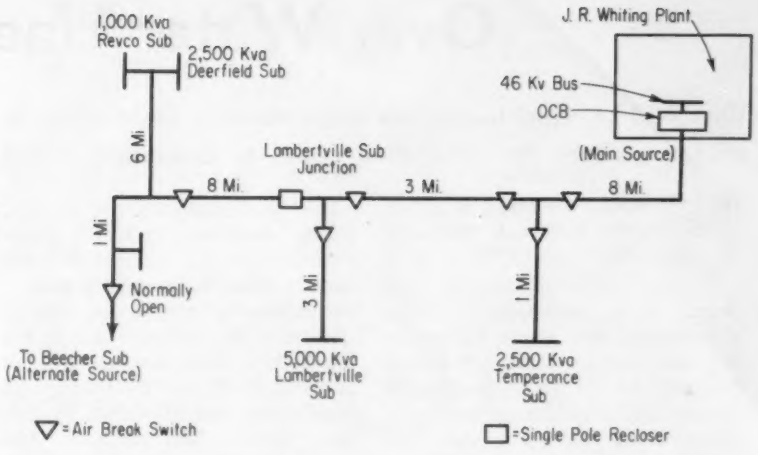
System oscillations (ferro-resonance) have resulted



SINGLE-POLE RECLOSERS, set for operation before installation, perform in accordance with time-current chart



INTERRELATION of the functions of protective devices is shown in the charted time-current characteristics above



SINGLE-POLE RECLOSERS were installed at Lambertville Junction to protect circuit from Whiting power plant from faults on line

from switching operations. But single-phase fuse operation has proved satisfactory, and system constants and their reactions during single-phase switching and fault conditions have been such that no difficulties are anticipated. It has been estimated that not more than 3 to 4% of the faults will produce single-phasing. In such instances, the resulting conditions will be the same as those from operation of one primary fuse or one single-pole recloser.

Properly, the 3-pole reclosers at Quincy substation should be considered breakers; they require external sources of intelligence and operating power. Their application becomes a problem of relay coordination in accordance with well-known practices. These 3-pole reclosers are rated 400 amp continuous and have 250-Mva interrupting ability at 46 kv.

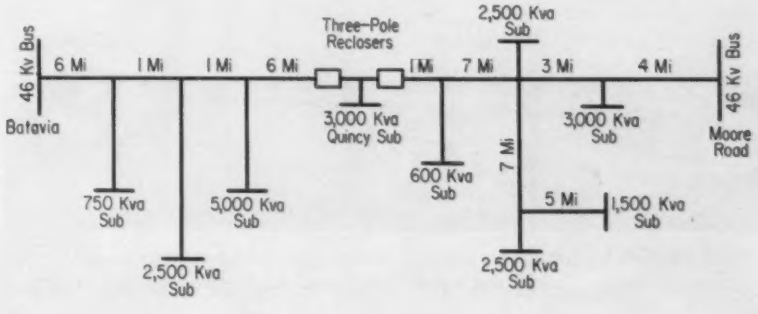
Reclosing coordination took more study than fault-clearing coordination, as the reclosers are in a loop line with two definite sources, one at each extremity. Reclosing at the sources follows a sequence of three operations at 5, 25, and 120-sec intervals, the sequence common throughout the system. Quincy substation reclosers were set for two operations at 15 and 120 sec. This setting allows the source to test the line.

When the source energizes the line, the recloser tests and closes, as the source has already established line voltage and energized the power supply for the recloser. Alternatively, the power supply for the recloser can connect the opposite source for testing the circuit. The 15 and 120-sec timing allows independent testing.

These 3-pole reclosers' directional phase and ground relays permit recloser operation for faults only in the section of line into which their relays "look." Thus service to the area back of the recloser is maintained. The single-pole recloser sectionalizes during faults, thus increasing service continuity. The 3-pole recloser permits operation of loops, improving voltage level and stabilizing and distributing power and kilovar flow. These improvements, in turn, afford better voltage and line power factor and release line capacity for load-carrying.

The 3-pole recloser program has been augmented since development of the transistorized bushing potential device which supplies the correct voltage signal to the directional relays. A transistor amplifier amplifies the very weak voltage signal from the 46-kv condenser bushings. Although the Quincy unit was installed on an existing steel substation structure, ordinarily a 3-pole recloser can be installed on either steel or wood structures.

Cost of the 3-pole recloser installation with directional relaying runs to about 70% of that of a comparable breaker installation. Single-pole reclosers were installed with non-directional overload coils at about 40% what a breaker installation costs. These figures make the recloser attractive for use in outlying areas where fault duty is moderate.



THREE-POLE RECLOSERS were installed on each side of 46-kv bus at Quincy substation, in loop line with two sources

Over-Water Line Proves More

One 138-kv, steel-tower link costs Houston Lighting 63% of expenditure for submarine cable to Galveston Island

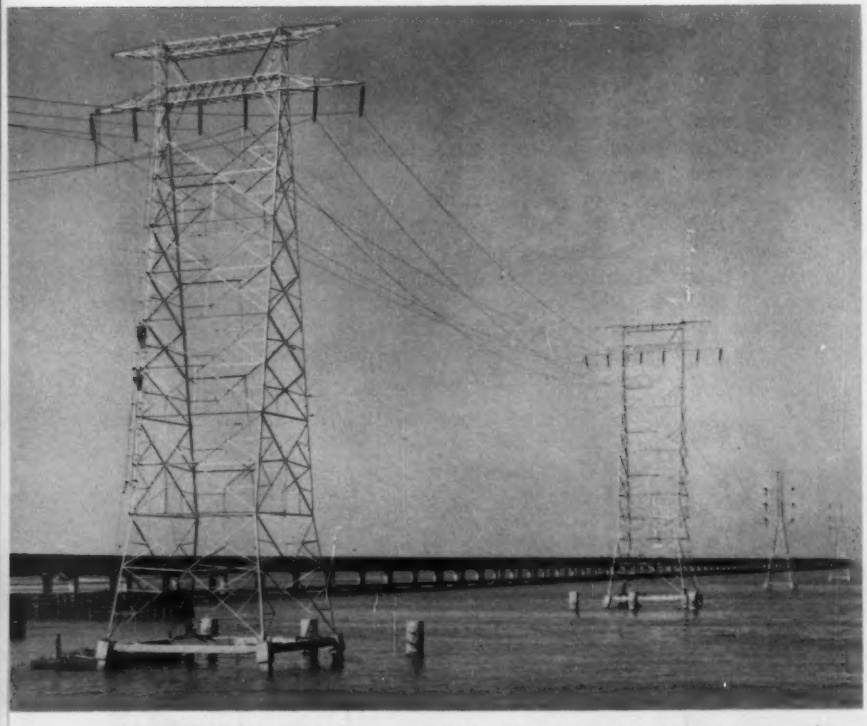
JACK H. HORN, Civil Engineering Division, Houston Lighting & Power Co, Houston, Texas

Towers and conductor for one circuit of an over-water, 138-kv transmission line across Galveston Bay cost Houston Lighting & Power Co only 63% of what a single submarine cable would have cost. Addition of a second circuit will provide, sometime in the 1960's, a double-circuit line at only 34% of the outlay for the two submarine cables which the company had originally considered.

This line brings a new and reliable power supply to meet the growing load on hurricane-exposed Galveston Island. The original service comprised a 69-kv single-circuit line on poles along the Old Galveston Causeway, a 69-kv submarine cable, and a 33-kv submarine cable which was operated at 12 kv.

The company elected a steel-tower line despite the obvious problems involved in its construction. It would have to traverse 1½ miles of Galveston Bay where water in the Intracoastal Waterway has a depth of about 15 ft, and the towers and foundations had to withstand 150-mph winds. The proposed line would link the mainland's Webster steam-electric station with the island's West Galveston substation over a distance of 26 miles.

Foundation designs for the towers over water were based on a safety factor of 2.0 above wind and dead loads. Seeking the best answer to the engineering problem and experience for future over-water crossings, the company had three complete designs made and accepted contractors's bids on each.



FLAT DESIGN for two towers was dictated by clearance requirements over Intracoastal Waterway and tower height limitations due to glide pattern of airport

The first provided for four 24-in. square prestressed concrete piles per tower driven on a batter. The second contained prestressed concrete piles also, one per tower leg, but they were of 54-in. OD, cylindrical, and driven vertically. This design included concrete caps for joining the piles, anchor bolts, and beams. Because of the cylindrical pile's stability, beam connections between legs were required only at six foundations in water deeper than 5 ft.

The third design, perhaps the most conventional, was the most expensive. In it, individual reinforced concrete piers supported the tower legs. The piers rested on groups of three or four concrete piles, the number in a group determined by requirements for strength in compression, uplift, and bending. As all three designs were considered equal in structural adequacy, the first was chosen as the least expensive, the successful bidder being Kansas City Bridge Co.

Preliminaries included drilling a core hole at each tower site and testing soil samples to determine precast concrete pile lengths. Full-scale pile loading tests at three representative locations proved laboratory skin-friction allowables. The project in the bay and approaches consisted of 27 double-circuit, 138-kv steel towers on pile foundations of which 19 were in water ranging in depth to 15 ft.

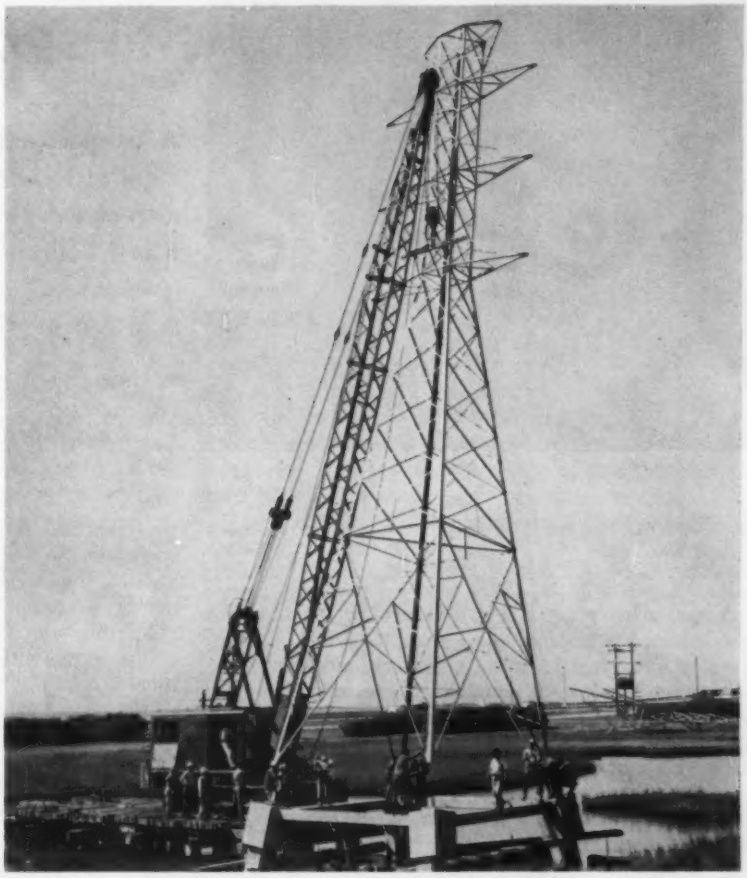
Of the latter 19, two were designed especially to hold conductors high enough to clear Intracoastal Waterway shipping and yet have their tops low enough to clear an aircraft-instrument approach path to the Galveston Municipal Airport. Two were conductor deadending structures; the other 15 tangent structures.

Leg loadings ranged from 93,000 lb in compression and 75,300 lb in uplift on the tangent towers to 196,600 lb and 182,400 lb in compression and uplift, respectively, on the deadended towers. Uplift was a major factor in loading, dictating the use of precast piles driven to a depth providing resistance to it as well as to compression.

Two special horizontal-configuration, or flat-arm towers were in-

Economic

stalled at the Intracoastal Waterway where clearance above mean low tide for navigation had to be at least 110 ft. These crossing towers are also within an instrument-approach zone to the airport where maximum clearance above mean low tide is 149 ft. These two conditions were met by arranging phase conductors and static wires in horizontal rows. Overall height of the towers above foundations is 139 ft, the static arm being 60 ft and the conductor arm 72 ft long.



TOWERS were assembled on the ground, barged when assembled to their locations and were then set on their prepared foundations in water by a crane

Repetitive Design Sought

Behind the foundation design of the over-water towers was the purpose of developing a repetitive design adaptable to various water depths. This was accomplished by placing single 24 x 24-in. precast prestressed concrete piles at each tower leg on the leg batter, pile lengths having been already calculated to fit the soil condition, water depth, and leg loading at each tower.

Placing the piles on the proper batter made pile loading axial, regardless of water depth. This placement overcame the difficulty of providing for increased movement due to horizontal wind loading as water depth increased. Precast concrete beams connecting the piles assured movement of all four legs as a unit when piles were deflected by wind, waves, or stray boat collisions.

Piles and beams were cast in a yard at Pasadena, Texas, on the Houston Ship Channel and barged about 40 miles to the construction site. The yard had been set up previously for casting prestressed and reinforced concrete components for the Pelican Island Bridge. Transmission tower foundations were tailored for piles similar to those cast for the bridge, so that advantage was taken of a production line already set up.

Piles are 5,000-psi, steam-cured concrete, pretensioned in a Freyssinet bed. The 24-in. square cross-section has a 10-in. dia hole. Prestressing tendons are 30, ⅜-in. strands initially tensioned to 12,000 lb each. Pile lengths are 35 to 70 ft. A retarding densifier, added to the concrete, increases compressive strength and gives a dense, crackless product that resists sea-water corrosion. Deformed steel dowels, cast into one end of the piles, afford connection to the foundation cap. Precast beams are simple reinforced concrete having a 5,000-psi, 28-day strength.

In the two special towers at the waterway, the side beams are 38 ft long and require the use of corner brace beams. Side beams were canted to the side bevel of the piles, such angling facilitating the placement of steel dowels and anchor bolts in the caps.

A barge-mounted driving rig using a steam hammer drove the piles, which showed no distress in either the handling or heavy driving. They were held in position and batter by a steel template on pontoons. Pile bottoms tended to creep away from the tower centerlines during driving because of the weight of hammer and leads on top of the pile which was leaning toward the tower center. But the contractor compensated for this drift by starting the drive with the pile somewhat vertical to the design batter. Variation from design location of piles necessitated the use of a cap 12 in. larger than the pile to join the pile, beams, and anchor bolts.

Cap concrete was delivered by transit mix trucks to points on the Old Galveston Causeway where it was chuted to a 1-cu-yd bucket on a barge. Concrete was barged to the foundations and lifted to steel-cap forms by a steam-operated, barge-mounted, 360-deg turning, 40-ton Whirley crane. That placed in the caps was the only concrete poured over water.

To forestall corrosion, anchor bolts and top nuts are stainless steel, and base shoes, tower steel, and bolts are heavily galvanized.

(*Continued on page* 140)

Psychology Helps

A unique approach to executive development at New Mexico Public Service lets key men chat with an industrial psychologist for a few hours each month. This program:

- **Makes executives more effective leaders**
- **Helps spot potential in younger men**
- **Draws "practically unanimous praise"**

W. GRANT LOFTIN, Public Service Co of New Mexico, Albuquerque, New Mexico

For over two years, Public Service Co of New Mexico has retained a psychological consulting firm to help develop individual potential of its key personnel. The consultants' industrial psychologist, working through personal interviews and counseling sessions, helps each executive to fit more smoothly into the group, and to increase his own effectiveness.

Today, though nobody at Public Service would tell you that all management development problems are solved, there's almost general agreement the program has shown far-reaching, rewarding results.

Public Service, a busy, growing utility, faces the universal problem of getting the right executives for the right jobs, and keeping them productive.

Pres D. W. Reeves of Public Service had previous experience with the consulting firm's psychological services, and recognized the company's need for what the consultants could offer. A few months after becoming president in 1955, he engaged the firm, which assigned Dr J. W. Thomas, one of its staff psychologists.

'We Can Leave No Stone Unturned . . .'

Public Service wasn't trailblazing. Psychological service to business is accepted increasingly as one means of meeting complex management, executive, and personal problems. As one manager put it: "It's the result of a realization, with today's challenges and pressures, we can leave no stone unturned to obtain the best production from the most competent key people available."

But Public Service's program, as one of the very few in the utility industry, provides a rewarding study of a good testing ground for the management psychologists' specialized knowledge and skills.

Significantly, despite mounting problems of load growth, Public Service's management team now has settled into its task with added assurance and efficiency. Much of the credit, company executives believe, is due to the psychological service's influence.

Dr Thomas and his associates liken a company to a pyramid, built from top down. They believe the man who can best use their services is the man most responsible. So Thomas began his work with the person his firm thinks the strongest—or the weakest—link in the organization: the president.

Starting with Pres Reeves, Dr Thomas devoted his efforts to the entire executive staff and other key personnel. The program now includes regular visits with all the people within the "consultion bracket".

Dr Thomas emphasizes repeatedly: the people he consults aren't "sick", nor are they considered in trouble. On the contrary, they're successful men who want to become more successful.

The program's overall aim is developing the individual's potential—helping him grow personally so he can better cope with the company's problems. Another target is to help top management people to "understand"—themselves, fellow workers, relationship to their own jobs, obligations to the company and, possibly most vital, obligations to themselves. Dr Thomas put it this way: "We make psychology's resources available to executives trying to get a job done through people."

Fundamentally the service helps management:

- To fit organization to human resources.
- To improve personnel selection and upgrading.
- To be more effective leaders.
- To build a more effective team.

There is nothing original about these; all have been used before. The approach is the unique part.

Little is said about "organization", "team" or any other catch phrases. Dr Thomas interviews and counsels each person as an individual. The effect, however, is that each person, in reaching for his own growth pattern, fits better into the group. Net result, company officials are convinced, is a smoother organization.

An indication of top reaction was expressed by a vice president, 35 years with the company. This man said: "There has been a lot more thinking around here since Dr Thomas came, than there ever was before."

The results can't be put into concrete terms, but the participating executives are practically unanimous in their praise; they agree that it is worth the time and money expended.

Counseling time varies with the executive's posi-

Make Good Executives Better

tion. Dr Thomas averages two three-day visits per month and sees each executive for an hour or more each visit.

Reaction of employees below the executive level is also important—although often it is difficult to get their true feelings. The only effort to publicize the psychological service was a story in the employee magazine, but comments of rank and file employees indicate a growing awareness that psychological consultation helps them indirectly.

Early individual reactions to the program were varied. At the start, a few were wary of the psychologist, though most now realize the program's value. Showing the respect Dr Thomas now engenders is the remark of an executive: "I'd jump from my chair to greet [Dr Thomas] anytime." Thomas is looked upon as a non-ax-grinding friend, and a good listener.

As a specific example of an area in which the service is valuable, Dr Thomas cites the problem of the older man who seems to have hit a career road block. Consultation might show the man better fitted for a different job, one where he could step upward more confidently. Or it might show up an "external block" as merely inability to take advantage of others' help.

Dr Thomas also aids in spotting management potential, particularly in younger men. Once he locates a growth potential, he helps guide management and individual toward a mutually satisfactory goal.

The importance of identifying and evaluating is why many younger men are interviewed by the psychologist before they are hired. Even if the only result were a negative report on the man's potential, company officials say, it would save costly and time-consuming mistakes.

Dr Thomas's firm feels that it is not enough to add a new man merely to fill a job. He should also be evaluated for potential to grow and progress. Public Service executives feel this philosophy has turned up some outstanding young people who might otherwise have been overlooked.

The consulting firm's services are engaged by mutual agreement. There is no contract, and either party can terminate at will. However, Public Service is continuing the program. It is felt the service will become even more valuable with continuing association and increased confidence in the psychologist, much as a legal firm's services become more valuable after long association.

Dollars and cents value can't be put on the results. The best measure is the total impact upon the organization's leadership and the general improvement in the company's human resources.

Training Is a 'Line' Responsibility

Here's how Union Electric Co makes every boss a teacher; and it helps the supervisor as much as it helps the trainee

OREN P. STAMSTAD, Manager, Educational Division of the Employee Relations Department, Union Electric Co, St. Louis, Missouri

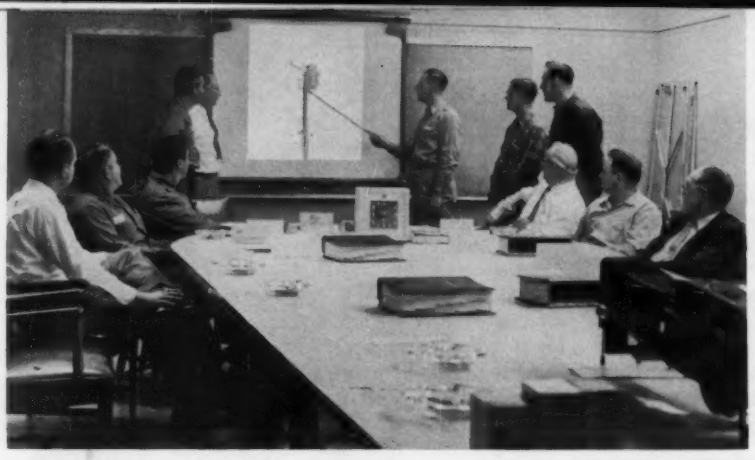
In American industry, there is general agreement on the need for more and better training. There is not such universal agreement as to the best way of providing that training.

Management often tends to regard training as a special skill—something to be left to a special staff of "trainers." At Union Electric Co, however, as at an increasing number of companies throughout the country, training is a line responsibility. It is a part of the daily business of running the enterprise. It is "built in."

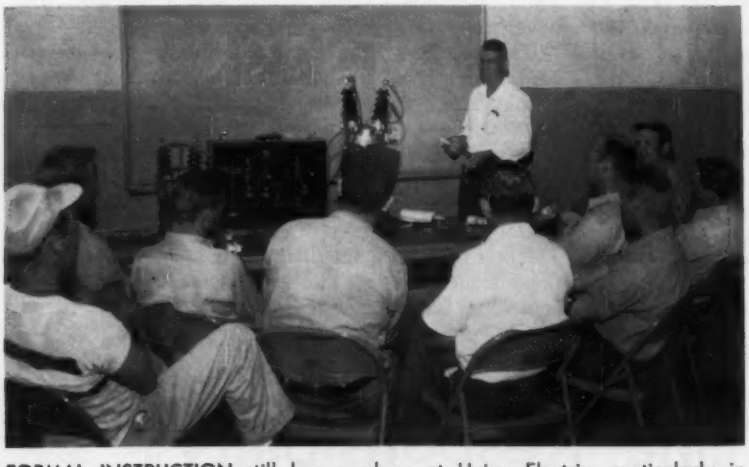
The first responsibility for training is charged to each person who supervises others. Each "boss", regardless of his organizational level, either conducts or sponsors the training and development of each person reporting directly to him.

The educational division of the company's employee relations department stimulates and supports these line training activities. It plans and coordinates training throughout the company. Where training activities cross departmental lines and where other common sense judgements dictate, the educational division also is active in implementation.

But, for the most part, imple-



LEARNING HOW TO TEACH, Union Electric supervisors assign work to each other in advanced session. Afterwards, other "bosses" give a critique



FORMAL INSTRUCTION still has a place at Union Electric, particularly in covering theory. But its purpose is to supplement "on-the-job" training

menting training activity is a function of the operating departments.

This overcomes one disadvantage of leaving training to a central training staff. Although a good centralized program is usually well-coordinated and stems from much thoughtful analysis and planning, it sometimes lacks sustained encouragement and day-to-day direction from the line organization. Every supervisor is not made to feel that he is a trainer.

At Union Electric, the educational division supports the supervisor.

The division is organized into three working units: Management development; training coordination; and safety.

All management development efforts aim at improving management by improving the managers. Toward this objective, the management development unit directs a number of programs dedicated to developing skill in the use of the coaching cycle.

Done in a climate of human understanding, the coaching cycle is a continuing, three-phase, on-the-job activity:

- Delegate (give a man something to do).
- Observe (watch how he does it).
- Counsel (talk it over with him).

Once a supervisor gets into the coaching habit, he never stops. It is within this coaching framework that the supervisor develops both the individual and the team while actually turning out the work.

At Union Electric, we have found out that it makes no difference whether you are training a welder, a boiler operator, a fire fighter, or a supervisor—the coaching cycle works. The supervisor who says he doesn't have time to train his people has not learned the "abc's" of his day-to-day coaching routine. Once he has mastered the fine points of the three-step cycle, he has the best tool available both for developing his people and for getting the work done. Moreover, skillful and repetitive use of the cycle makes training a time saver, not a time taker.

Training in basic supervision is being given to all supervisors, the experienced as well as the new. It is presented in a concentrated, three-week (all day, five days per week) package. When all present management members have participated, this program will continue as the initial introduction to management responsibility for all new supervisors.

The sessions, combining lectures and discussions with provision for practice in leadership by people in the group, cover such subjects as: Influences on human behavior, coaching, authority, work assignment, union-management relations, economics and finance, employee relations policies, safety, and applied leadership.

High Participation Limits Size

Sessions are characterized by a high degree of participation, and for that reason each group is limited to a maximum of fifteen people.

Leadership comes from three sources. The early-morning sessions are led by members of the management development staff. Mid-morning sessions are informative presentations led by company experts. The afternoons are devoted to workshop practice in conference leading. Participants take turns leading group discussions on real supervisory problems.

Consideration of work assignment spotlights the fact that in the commonplace, repetitive, supervisory act of assigning work, the "boss" has a ready-made framework for some of his most productive employee contacts. His daily coaching relationship, "getting the work started right", sets the whole work climate.

Proficiency in work assignment is so essential to good management that, upon graduation from the basic course, supervisors are given advanced training in a separate work

(*Continued on page* 83)

TRANSMISSION
Equipment News
DISTRIBUTION

Now Is the Time to Identify Values

by **D. K. BLAKE**

D. K. BLAKE, widely known engineer, economist and editor, is the Economic Consultant to User Industry Sales, General Electric Company.

Now is a good time to revive some of those studies and projects that were laid aside because management needed its available money for generation and major transmission expenditures. Distribution had to wait, for it could always be made to work after a fashion.

Once given the appropriations for these projects, it is of the utmost importance for you to guide your purchasing management so they can fulfill their obligation to get the most value for your company's money. Now, value has two definite, and distinct aspects. The first is *Value-in-use*. Your company buys "usefulness" or "utility." No more and no less. This *Value-in-use* is supreme. The second aspect of value is *Value-in-exchange*—the dollars you will pay in exchange for such usefulness.

A product having added value in the sense of added utility or added usefulness gives the greatest *Value-in-exchange* when your suppliers' prices are the same. Comparison, therefore, is essential in order to determine the added or marginal usefulness of products which are approved for use on your system. You, the user, must make this comparison for your purchasing manager. He is not in a good position to know the usefulness of features claimed by suppliers. Your buyer is in danger of thinking that the products of all suppliers on the so-called approved list have equal usefulness. He may, therefore, exercise his choice on some grounds other than *Value-in-use*, and consequently not get his best product *Value-in-exchange* for a dollar. To that extent he fails in his desire to make his purchases count the most in contributing to the profitability of your company. Therefore, he must rely on you, the actual user, to give him this comparative information so he can make a sound purchasing decision.

Our sales engineers, product specialists and application engineers will welcome your request to compare our products' worth in added *Value-in-use* to your company.

OPERATION upturn
GENERAL ELECTRIC

Now is the time to buy for extra values . . .

an EXTRA VALUE product feature

OPERATION upturn — Buy now for extra values — GENERAL ELECTRIC

1-ϕ 250-kva on the pole

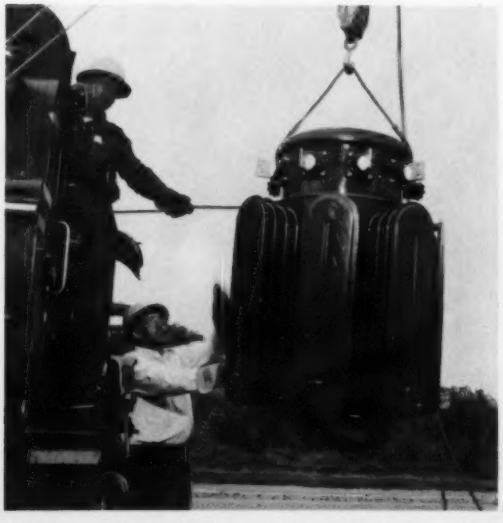
1750-pound unit gives extra value where space is at a premium

This completely new pole-type transformer is solving many location problems in crowded urban areas. Small size, light weight and improved electrical characteristics result from basic design improvements. New radiators and a new core-and-coil design, for example, help keep weight down, performance high.

No unusual equipment is needed to install the new 250-kva units.

They are equipped with Type C support lugs, oil-drain plug and sampling device, liquid-level marking, and internally operated tap changer.

For operating characteristics and delivery schedules, call your nearby G-E Sales Office.



250-kva pole-mounted units result from a new core-and-coil design and new panel radiators which help keep weight down.

3-ϕ 225-kva on the pole

Cut installation costs, solve location problems with 2500-pound pole-type units

Substation transformer ratings, on the pole, mean money saved in initial investment and installation costs to users of these new lightweight G-E transformers.

The large reduction in pounds per kva of capacity is due to a unique design of core and coils and the use of improved magnetic steel. With substation capacity now available in pole-mounted units, many location problems in crowded areas are solved with major savings in construction and installation costs.

The new lightweight transformers shown in the photos are rated 225 kva, 4160 volt, 3 phase. For complete information, contact your nearby General Electric Sales Office, or write to General Electric Co., Section 431-76, Schenectady 5, N.Y.

GENERAL ELECTRIC

Crowded locations are readily served with G.E.'s new 225-kva pole-mounted transformers. 3-phase units weigh 2500 pounds.

*Implications of the New "Evans" Core**

HAROLD BRUNTON, JR.

Manager—Network Transformer Sales

It has been said that many important developments are remarkably simple in their concept. Certainly this is true with the new "Evans" core, which is a major design advance and yet fundamentally straightforward.

Designers have considered using a wound core for network transformers ever since 1937 when G.E. introduced a spirally wound distribution transformer core using cold-rolled strip steel. However, large transformer ratings and three-phase units presented complex design and manufacturing problems. Tom Evans solved these problems by using two wound cores and then winding a third core around the other two.

Straightforward as this approach seems, to put it into practice required years of development, including new materials, new design techniques and the use of new manufacturing methods. One by one these individual problem areas were conquered.

The designers were continually faced with the fact that network transformers must meet more stringent requirements than most other transformers.

Short-circuit strength must be higher because of network system characteristics. Losses must be lower to minimize heating because the units are usually installed in small confining spaces. Corrosion resistance must be greater because the units are often completely flooded by contaminating liquids.

We believe that a remarkable reduction in size is made in the new "Vaultmaster" network transformer. Even more remarkable is that it was accomplished without sacrificing any of the other characteristics which have long been offered by G-E network transformers. In fact, further improvements have been made in many of these characteristics. We believe, therefore, that the "Evans" core definitely means ***extra values*** for our customers.

*Named after its originator, T. M. Evans, a G-E transformer design engineer.

New Core, New Radiators, New Thermal Design in "Vaultmaster" Networks

Smaller, lighter transformers simplify installation and maintenance

The new G-E "Vaultmaster" design represents important advantages for network users. Smaller transformer size can mean less expensive vaults, easier installation, and often increased kva capacity for existing vaults. For example, a new 750-kva unit is about the same size as the former 500 kva. Three innovations make the smaller size possible.

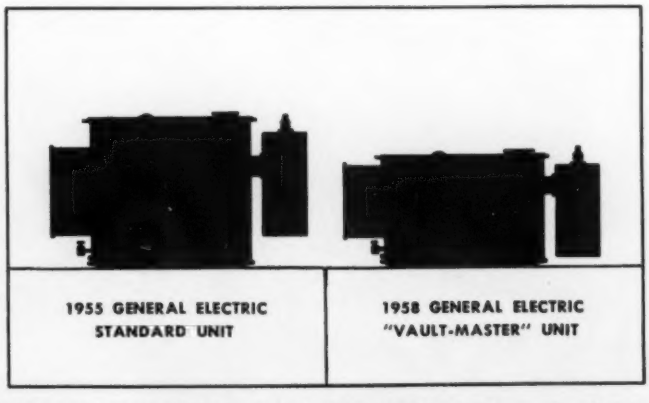
The "Evans" core is a new design which makes it possible to use the famous G-E Spirakore† core construction on large three-phase units. This core utilizes the grain-oriented cold-rolled strip steel to its best advantage, resulting in smaller core and coil size and improved characteristics.

Panel radiators provide a tremendous amount of heat dissipation in a small space. In addition, this radiator design cuts down the number of tank openings and gives a smooth, uncluttered surface that is easy to keep clean.

Balanced thermal design is the new G-E approach to winding design which balances the thermal increments to provide the maximum of overload capacity. Facilitated by the extensive use of computers, the new winding design also increases reliability.

†Registered trade-mark of General Electric Co.

DRAMATIC SIZE REDUCTION IS EXTRA VALUE

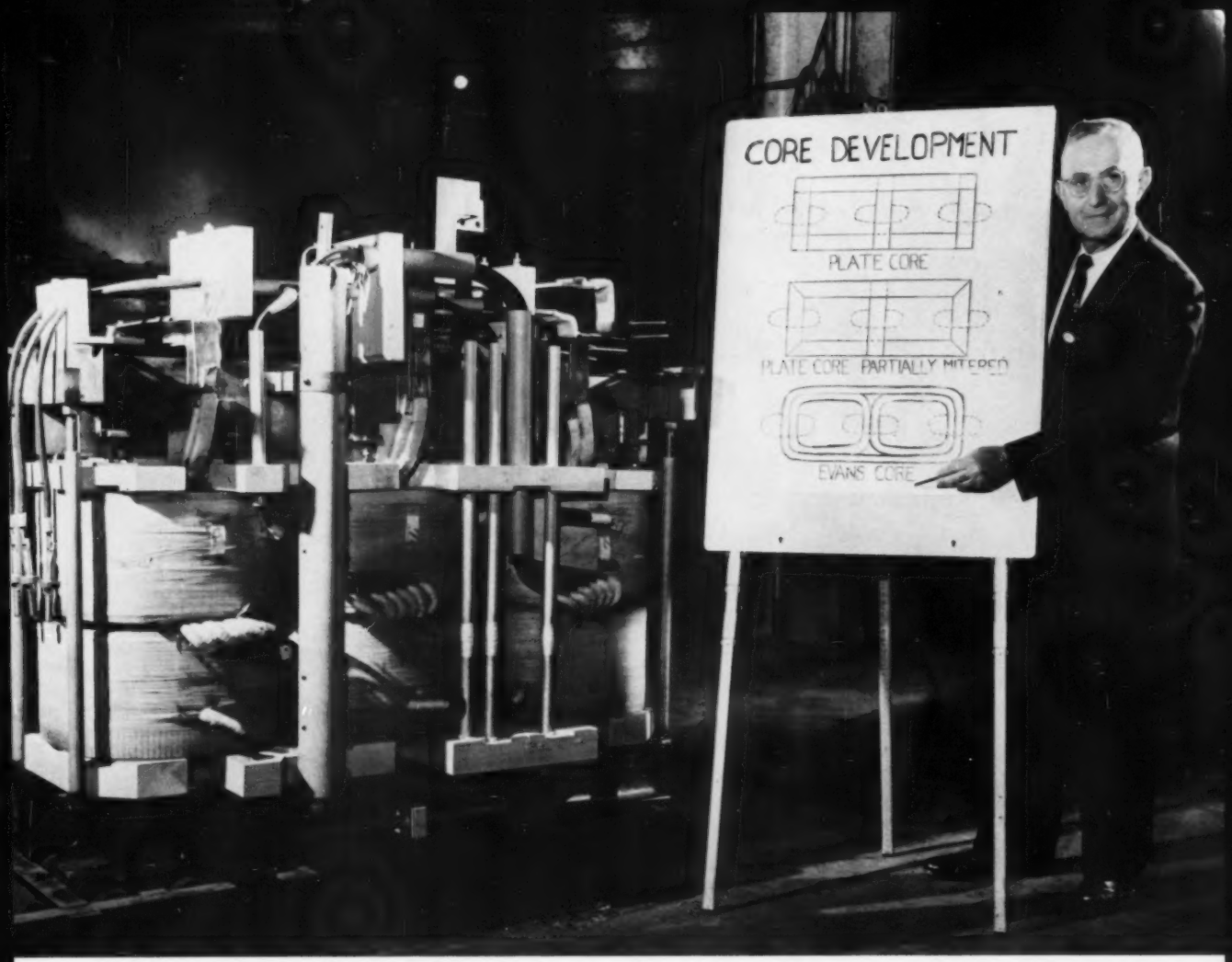


VAULTMASTER SAVES ON FUTURE CHANGES with its new low height. There is ample space for addition of higher-rated units or oil-fuse cutouts or capacitors. Smaller size gives "elbow room" for easier maintenance.

an EXTRA VALUE product feature

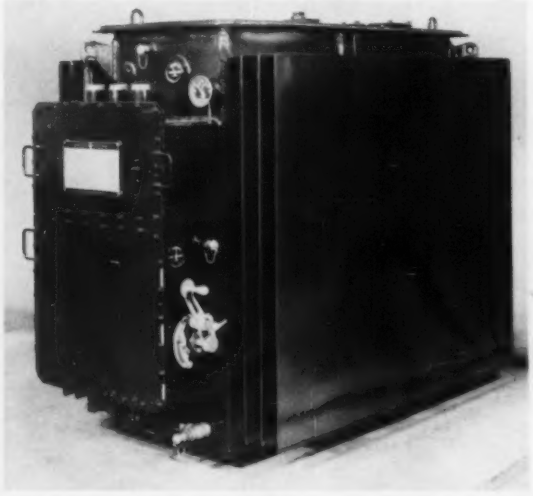
OPERATION upturn

GENERAL ELECTRIC



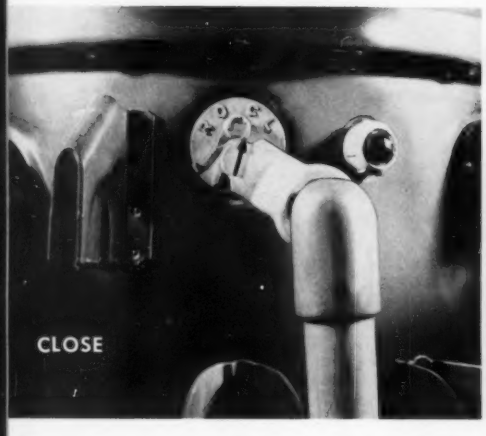
NEW CORE DESIGN for G-E network transformers is shown by its originator, T. M. Evans. Chart shows evolution of core design from 1955 when all standard network units featured plate-core construction. At the left is a new 750-kva core and coil unit, featuring the Evans design which means smaller, lighter transformers.

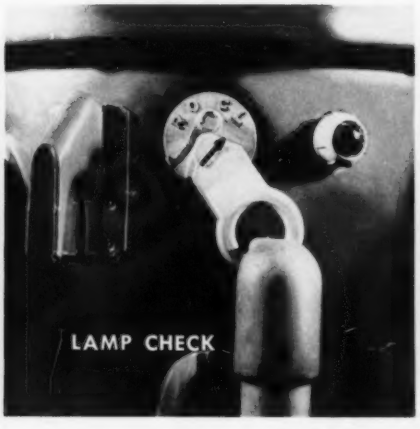
BALANCED THERMAL DESIGN tests prove even, controlled heating, reduced hottest-spot temperatures, resulting in extra-long transformer life and increased loading.

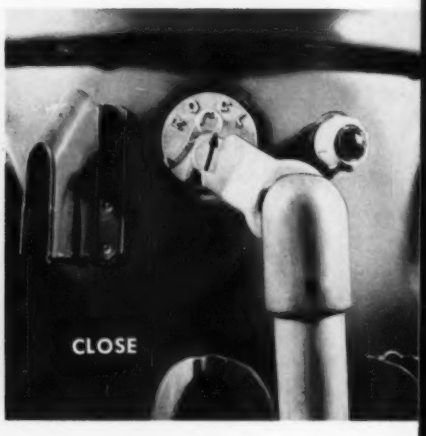


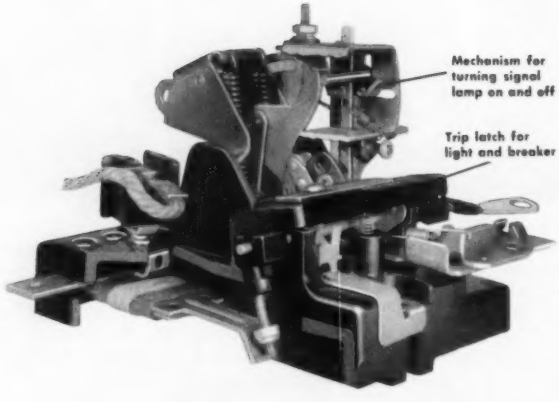
G.E.'S PANEL RADIATORS increase reliability since there is less chance for leaks with only eight entrances to tank. Smooth panels are easy to keep clean on these units.

Two New Money-Saving Extra Values with General Electric Distribution Transformers









Every G-E breaker lamp now checked easily without removal from transformer

This convenient lamp-test provision is now available on all General Electric self-protected transformers. The sequence photos above show how the lineman can check the lamp quickly, without removing it from the tank. This provision has been added to the AHT-1 breaker (at left), which is used on units below 37½ kva rating. The G-E T-2 breaker—for units 37½ kva and above—has the same lamp-test feature.

Bushing keyed to tank cover won't turn as lineman tightens connection

Linemen like this added value feature of G-E distribution transformers. Terminal bolts can now be tightened with a one-hand operation since in addition to keying the terminal bolt to the bushing, G.E. now keys the bushing to the tank cover as well. Thus, the bushing will not rotate in the cover seat when the lineman tightens the terminal bolt.

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OPERATION upturn — Buy now for extra values — GENERAL ELECTRIC

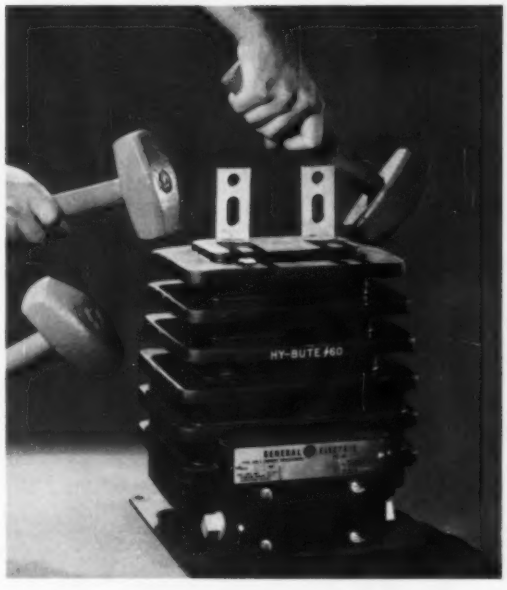
NOW Extra Values of Tough BUTYL . . .

. . . in 15 types of instrument transformers

Being tough, butyl supplies a lot of extra values to G-E instrument transformers. Some of these values are: longer life, safer operation, easier handling, simpler installation, and reduced maintenance.

On top of that, you'll get a certificate with each unit that certifies the transformer has passed insulation and accuracy tests.

The butyl family has been growing steadily. It now has 15 types. Current transformers completely cover the range from 600 volts to 15,000 volts, for indoor and outdoor service. And, potential transformers are now available for 5,000-volt service, both indoor and outdoor.



TELEMETERING

EXTRAS . . . in new equipment for 5–15 Cy per Sec

Now you can get a system that will transmit signals over low-cost channels. It's made possible by General Electric's new equipment for operation at only 5–15 cycles per second.

More than that, we can furnish a completely coordinated system, including a new wide-chart potentiometric recorder—all nicely packaged* on a panel or in a cubicle.

If you've been postponing telemetering because of high-cost transmission, give us an opportunity to quote on our new 5–15 cps.

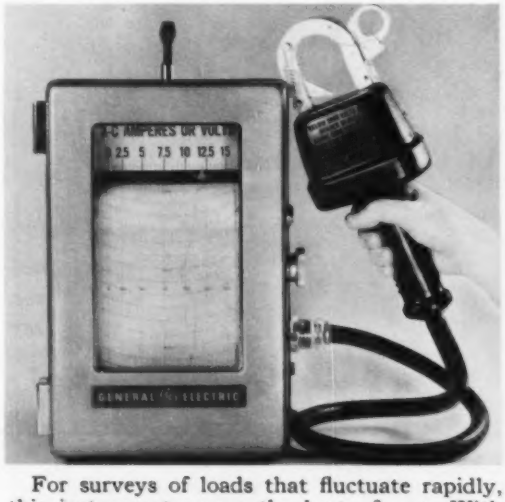
**Our ability to furnish the customer with completely packaged systems recently influenced two utilities to purchase General Electric telemetering systems.*

Also for Utilities

- **Switchboard Indicating Instruments**
- **Switchboard Recording Instruments**
- **Portable Indicating Instruments**
- **Portable Recording Instruments**
- **Automatic Dispatching Systems**
- **Leak Detectors (three types)**
- **Turbine Supervisory Instruments**
- **Reactor Instrumentation**
- **Automatic Time Switches**
- **Automatic Oscillographs**
- **A variety of Specialty Instruments**

NEW RECORDER FOR LOAD SURVEYS

Type CH-7



For surveys of loads that fluctuate rapidly, this instrument serves the best of any. With continuous inking, it responds fast and makes sharp, clear lines. With a spring-driven chart drive, it can be installed miles from nowhere. And, look, it just clamps on the line. Versatile, too; it has 6 current ranges—15, 30, 75, 150, 300, and 750 amperes.

In addition, you can also use it as a voltmeter. Ranges: 150/300/750 volts.

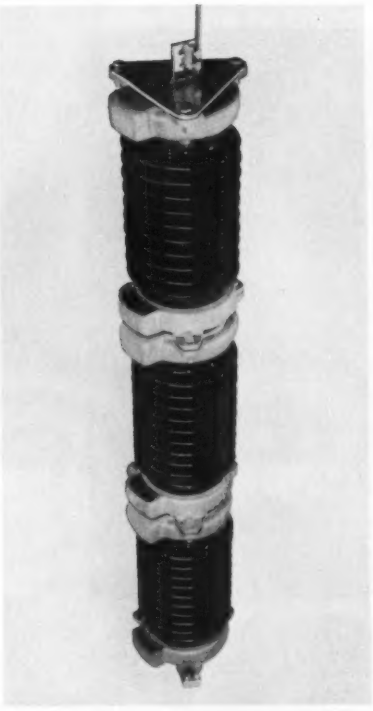
Consider, too, all the advantages of the CH recorder: throw-away inkwell, 60-day spring clock, two-month record rolls, and 28 possible chart speeds.

an EXTRA VALUE product feature

OPERATION up turn — Buy now for extra values — GENERAL ELECTRIC

Buy now—the new Form 3K arrester with

1000-Amp Long-Duration Discharge Capacity



The new G-E Form 3K station-class arrester helps your system meet the rapid changes coming in the next decade and provides premium operating characteristics at today's standard price levels. G.E.'s proven Magne-valve principle gives the 3K a 1000-ampere long-duration discharge capacity 570% greater than industry standards, and an improvement of 54% over G.E.'s popular Form 1H arrester. You can confidently adopt the Form 3K for use with two-step reduced BIL insulation for lightning currents in excess of 30,000 amperes through the arrester. Full operating and installation information is available at your General Electric Sales Office.

Revolutionary gap design has no coils or magnets

An extra-capacity Thyrite* valve ring is the key to the Form 3K arrester's long-duration discharge capacity. This Magne-valve action is shown in the diagrams below and occurs in this sequence:

1. GRADING CURRENT

Under normal voltage conditions, Thyrite gap shunting resistor gives uniform voltage distribution across entire stack.

2. IMPULSE CURRENT

Lightning and switching surges jump main gap and discharge to ground through Thyrite valve element. Pre-ionizer gives uniform sparkover.

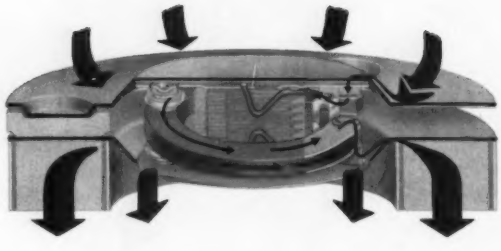
3. INITIAL POWER FOLLOW CURRENT

The magnitude of the power frequency follow current is limited by resistance of Thyrite elements. Gaps begin to extinguish current.

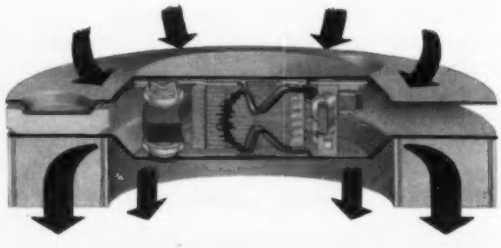
4. POWER FOLLOW CURRENT INTERRUPTION

Arc moves toward free end of horn gap, reinforced by flux action in auxiliary plates, breaking into 15 separate arcs.

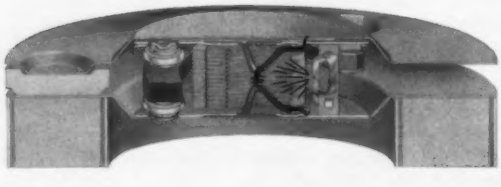
*Reg. Tradename of G.E. CO.



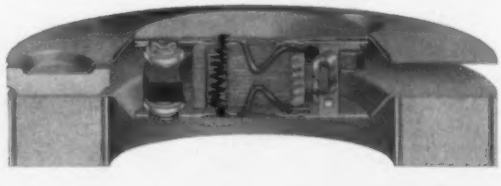
1. GRADING CURRENT



3. INITIAL POWER FOLLOW CURRENT



2. IMPULSE CURRENT



4. POWER FOLLOW CURRENT

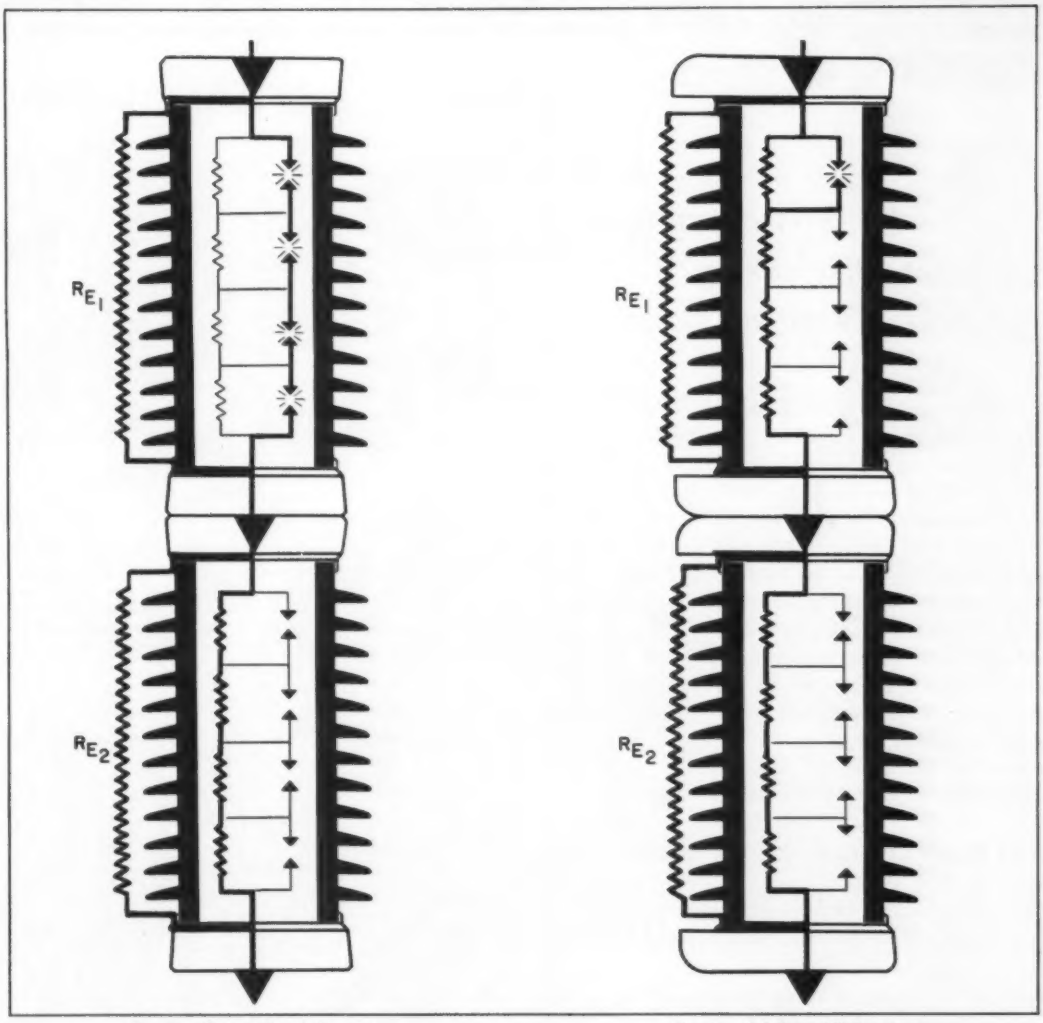


Fig. 1. Conventional Arrester

Fig. 2. G-E Form 3K Arrester

Anti-contamination Design

When arrester porcelain is contaminated, leakage current increases over the external path (R_E in figures above). Resistance drops on the wet surface, rises as it dries. Uneven drying causes an uneven voltage gradient over the stack. In ordinary arresters, internal gaps are evenly spaced. When one sparks, others on that unit follow, removing this unit from service, as shown in Fig. 1 above. If uneven drying continues to cause arrester sparkover, this could lead to a runaway condition resulting in arrester failure.

The new G-E Form 3K station arrester overcomes this fault with graded gap spacings. When contamination causes the voltage to jump the smallest gap, the others, having greater spacing, remain in service as shown in Fig. 2. The unit's resistance then more nearly matches the others, restoring uniform voltage distribution.

Burn-through pressure relief diaphragms, exclusive with G-E arresters, provide safe operation in the remote event of failure. Top and bottom apertures vent hot, pressurized gasses and form an external conducting path.

Ask for complete details on the Form 3K station arrester at your General Electric Sales Office, or write General Electric Co., 431-76, Schenectady 5, N. Y.

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NOW IS THE TIME

How General Electric capacitors can pay for themselves by reducing your operating costs

You can expect a 25 to 45% annual return on your investment when you buy General Electric power capacitors*. G-E capacitors can pay for themselves within two to four years, and can go on producing savings year after year after year. Such a high return on investment is possible because 50-Kvar units are now priced as low as $3.11 per Kvar, with switched capacitor equipments as low as $4.15 per Kvar. As a result, capacitors are now a more economical source of kilovars than ever before, especially in view of the high cost of generating and transmitting this commodity from your power stations.

Capacitors you add to your system can:

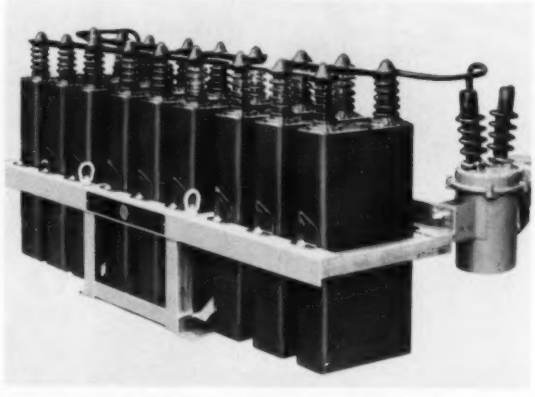
1. REDUCE KILOWATT-HOUR LOSSES. On a system operating at 90% power factor, you can expect each 50-Kvar capacitor located in the distribution area to eliminate 8500 Kw-hrs. in losses per year.

2. IMPROVE SYSTEM VOLTAGE LEVEL and allow more KW load to be served. Generally, over one-half of system voltage drop is caused by kilovar flow. Engineering studies show that, from a voltage-drop standpoint, system loading can be increased one KW for each Kvar installed in the load area.

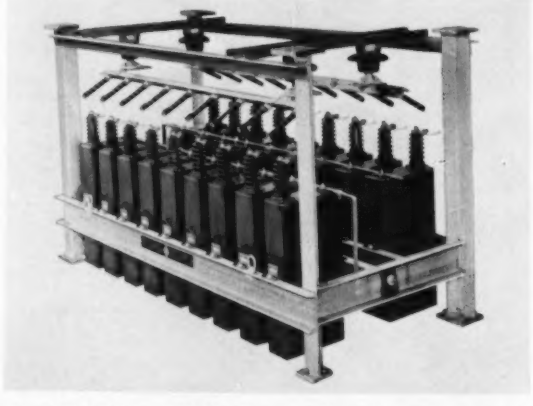
3. RELEASE THERMAL CAPACITY. By eliminating kilovar flow through transformers and other thermally limited equipment, capacitors will allow you to serve more pay load with existing equipment. For example, capacitors added to a system operating at 90% power factor will release nearly 20 KVA of thermal capacity per Kvar capacitor.

To begin producing these savings immediately; to help you handle present and future loads more economically; and to get extra value from your investment, now is the time to buy General Electric power capacitors. Contact your General Electric Apparatus Sales Engineer or write to Section 431-76, General Electric Co., Schenectady 5, N. Y.

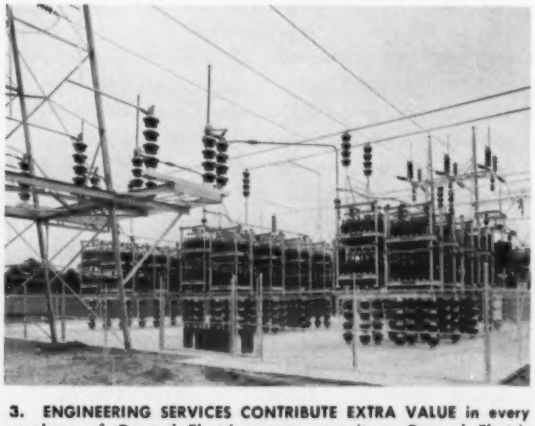
** Ask your General Electric Apparatus Sales engineer to show you the investment return capacitors can produce on your system.*



1. CORROSION-RESISTANT ALUMINUM RACKS provide their own protective coating. The framework of G-E open rack capacitor equipment like that of this pole-top bank will not require painting, even in the corrosive atmospheres of industrial or coastal areas. Accessories can be added in the field by simply drilling or tapping the aluminum frame; no protective touch-up is necessary.



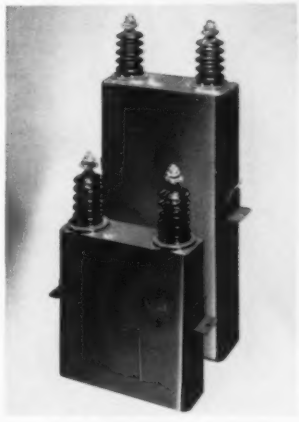
2. FAST, EASY INSTALLATION is possible with General Electric's complete line of factory-assembled capacitor equipments. Corrosion-resistant capacitors, fuse-holders and buswork have been pre-assembled in this lightweight aluminum stack rack to reduce your installation time and costs, thus giving you extra values.

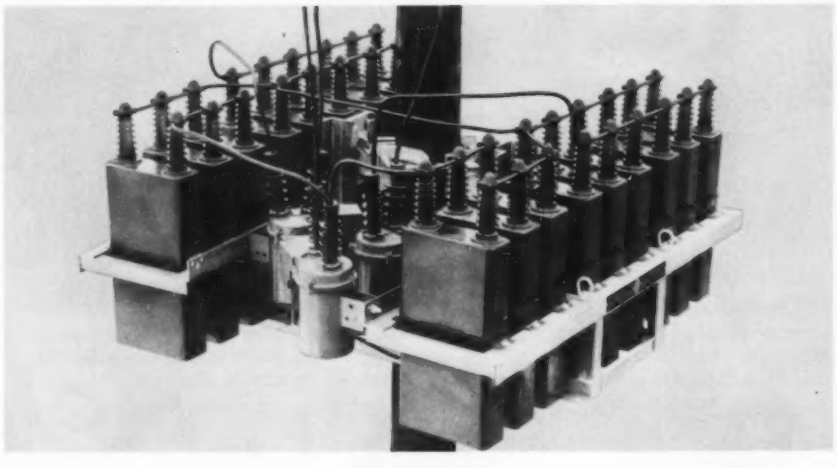


3. ENGINEERING SERVICES CONTRIBUTE EXTRA VALUE in every purchase of General Electric power capacitors. General Electric helped solve a customer's system problem by designing this high-voltage series capacitor installation. The tailor-made installation provides an economical balance of power flow over parallel lines.

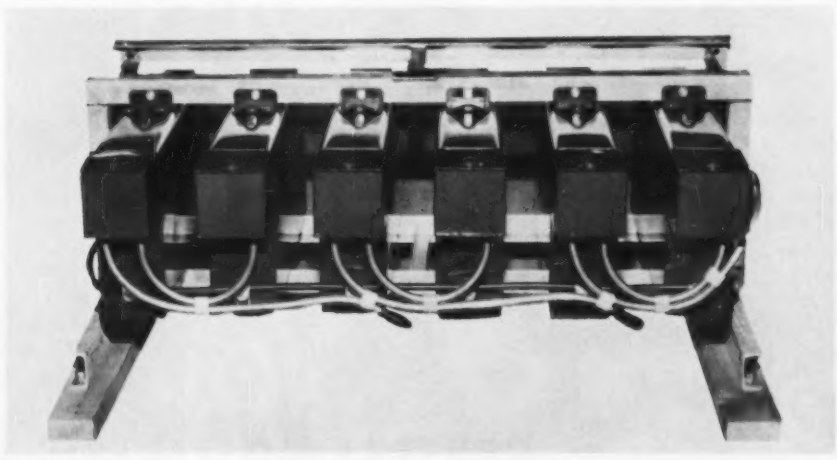
Seven Extra Features in Capacitor Equipment Help Reduce Maintenance and Improve Service

Ask your General Electric apparatus salesman for complete details on these extra features





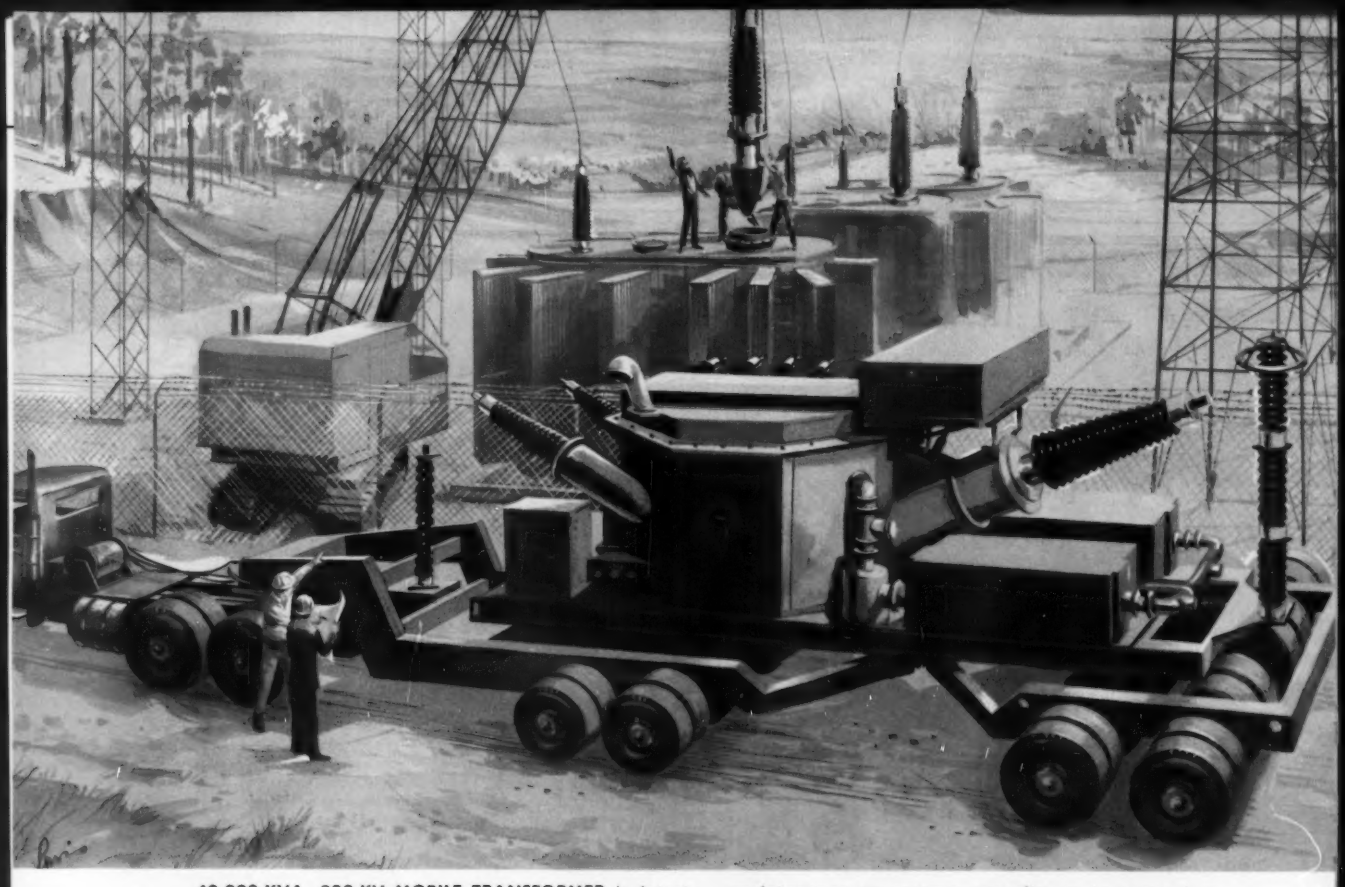
4. NEW POLE-TOP CAPACITOR EQUIPMENT IS BALANCED, EASY TO INSTALL. For larger capacitor banks on distribution feeders, a new G-E cluster-type, pole-top capacitor equipment is now available in ratings as high as 1200 Kvars. Perfect balance of this equipment means there is practically no bending moment on pole. It's quick and easy to install—a compression-type bracket squeezes the pole, eliminating the need for drilling and bolting. FKC oil switches can be located close to pole, in easy reaching distance for linemen. Structural material of corrosion-resistant aluminum is lightweight and requires no maintenance.



5. UNDERGROUND ENCLOSED CAPACITORS RESIST SUBMERSION. To help provide capacitor kilovars where there is no available pole space on an overhead system, or for entire systems underground General Electric developed this primary equipment for installation in vaults or man-holes subject to submersion. It is also ideal for surface applications in contaminated atmospheres where exposed bushings would become coated with conducting materials, or where clearances from live parts to buildings or personnel would not be adequate as with some other types of conventional capacitor equipment.

6. VIRTUALLY NO PAINT MAINTENANCE is required on General Electric power capacitors. The tough, corrosion-resistant case of these 50 and 25 Kvar units, and that of residential secondary capacitors, too, withstands rain, snow, salt-fog and contaminated atmospheres, and will not require protective repainting. To prove the durability of G-E capacitor case material, it was subjected to a salt-fog test in the General Electric Capacitor Department's Advance Materials and Development Laboratory. After 4768 hours, it showed not the least trace of corrosion or rust.

7. NEW SERIES CAPACITOR AIDS TRANSFORMER UTILIZATION. Increased loading of your distribution transformers is possible with this new low-voltage series equipment. Consisting of a secondary capacitor and protective gap, this equipment makes a distribution transformer virtually self-regulating. The gap, which prevents excessive voltages from occurring on the capacitor and transformer, removes the capacitor from the system under abnormal voltage conditions, and re-inserts it when normal voltage is restored. The corrosion-resistant capacitor case, stainless steel gap and alumina ceramic bushing and insulator contribute to the long, useful life of this secondary series capacitor equipment.



40,000-KVA, 230-KV MOBILE TRANSFORMER is latest evidence of General Electric progress in increasing mobile capacity while holding the line on size and weight. General Electric mobile equipment, used for maintenance or reserve capacity or to serve temporary or peak loads, means important savings in system operating costs. Many utilities are finding that larger ratings are providing ever larger savings.

PROGRESS IN G-E POWER TRANSFORMERS THAT PAYS OFF . . .

Mobile Transformer Rated 40,000 kva

Many utilities benefit with new higher-rated mobile substations and transformers as General Electric holds the line on size and weight

General Electric has spearheaded a major advance in the design and manufacture of mobile substations and transformers in the past few years. Only recently 5000 kva was considered huge for this apparatus. This year, in the 7500- to 40,000-kva range, G.E. has built or is actively working on more than a dozen mobile substations and transformers!

Innovations now in development will mean that this trend to higher ratings can continue for years without exceeding highway limiting dimensions. A better understanding of weight problems between the utilities and state and local authorities will also contribute to the wider application of mobile apparatus.

Mobiles are being used more and more as maintenance tools, as reserve capacity, and as a means of serving temporary or peak loads. The new, higher-rated G-E mobile subs and transformers magnify these areas of savings for utilities.

For information on how G-E mobile apparatus can help improve your system operating economy, contact your G-E Apparatus Sales Office, or write Section 431-76, General Electric Co., Schenectady, N. Y.

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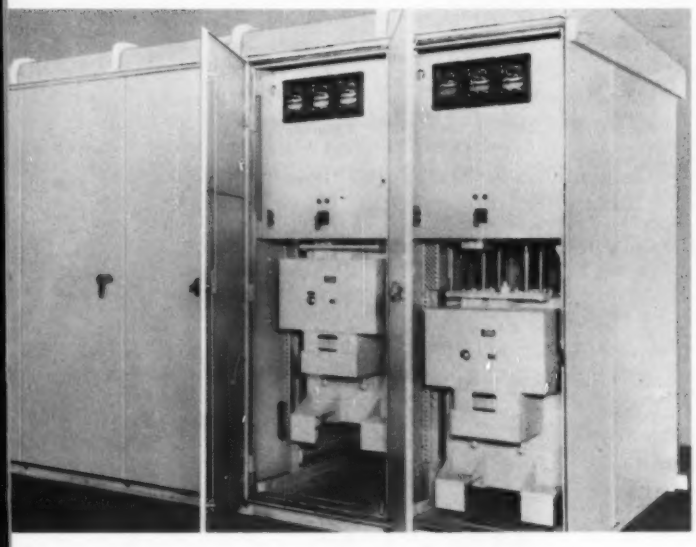
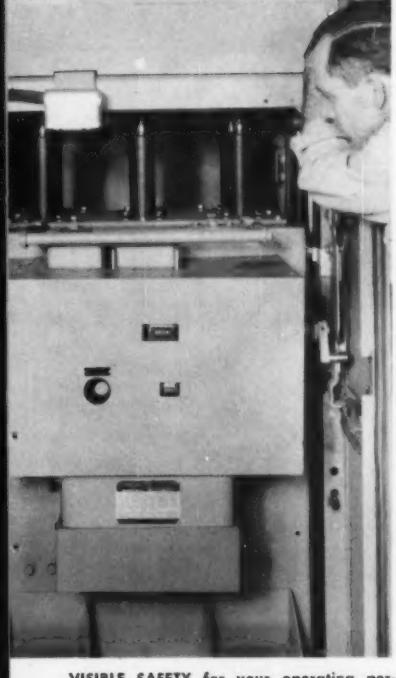
Creative Design Engineering Puts Extra Values in General Electric Metal-Clad Switchgear



A new design for General Electric's outdoor metal-clad switchgear typifies the engineering creativity which means extra values for you. Design resourcefulness now brings you these extra values in outdoor metal-clad:

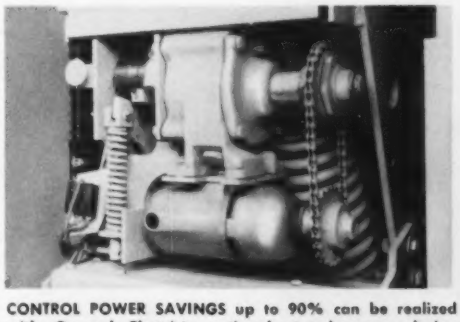
- **ONE-MAN OPERATION** and maintenance—all operations are conducted from the front of the switchgear, since control and protective devices are panel-mounted above the breaker.
- **SMALLER FOUNDATION SIZE**—rear aisle is eliminated, pad size reduced.
- **SIMPLIFIED FOUNDATION CONSTRUCTION**—power conduit need not be imbedded in pad.
- **EASIER INSTALLATION**—no skidding of switchgear over stubbed power conduit in foundation.
- **ALL-WEATHER MAINTENANCE**—a protected aisle is optionally available to shield your maintenance crew from inclement weather.

After checking these, and the other extra values on this page, call your General Electric Apparatus Sales Engineer for the details.

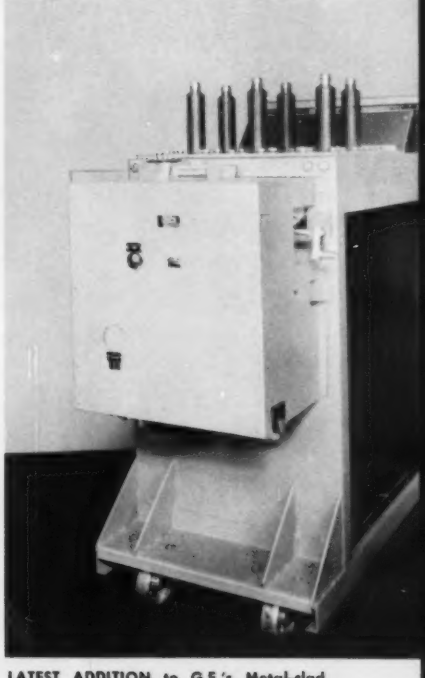


VISIBLE SAFETY for your operating personnel is a product of G.E.'s unique vertical-lift design. Operator actually sees when contacts part, and lower center of gravity cuts danger of breaker tripping.

FLAME RETARDANT SELF-X insulation, which will not support combustion and extinguishes itself almost immediately, is typical of G-E insulation advances.



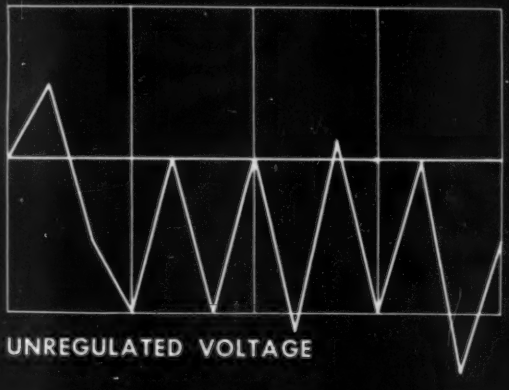
CONTROL POWER SAVINGS up to 90% can be realized with General Electric's optional stored-energy closing device. Another extra value—quicker, safer, manual operation and re-charging in the event of control power failure—more examples of creative design engineering.



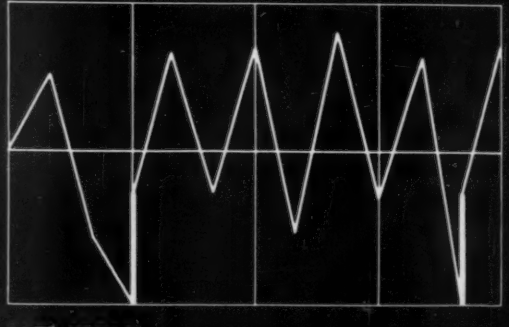
LATEST ADDITION to G.E.'s Metal-clad Switchgear line is the 1000-mva breaker. Complete line now includes ratings 2.4 to 13.8 kv and 75 to 1000 mva, and two-cycle interruption at 4.16 and 13.8 kv.

an **EXTRA VALUE** product feature

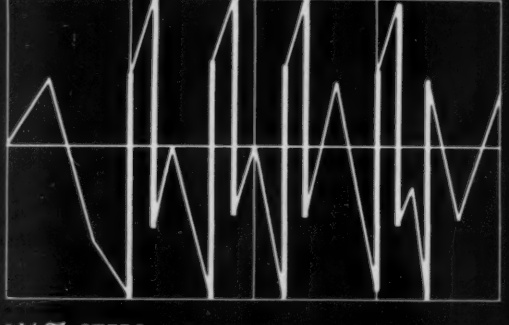
OPERATION upturn — Buy now for extra values — GENERAL ELECTRIC



UNREGULATED VOLTAGE



5/8% STEPS

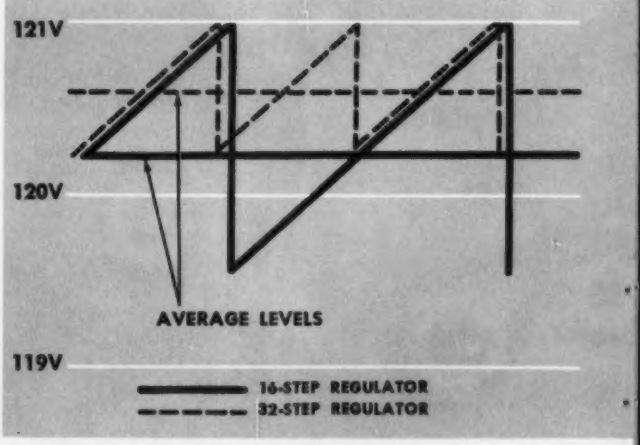


1 1/4% STEPS

The value of 32-step regulators

In actual practice, 32-step regulation offers the optimum *combination* of economy and well-regulated voltage. Here's why . . .

32-STEP REGULATION MEANS . . . . .



16-STEP ADVOCATES select the profile above to prove fewer operations, better average voltage. This assumes that voltage always changes in same direction. Actually, your system voltage fluctuates up *and* down. Realistic examples at left clearly show the facts. Thick, vertical lines indicate frequency of tap switch action.

32-step regulators provide closer regulation, longer life

32-step regulators on a typical feeder can be set to hold a closer bandwidth (a measure of profit and service) with less problem to the utility. This is true, although bandwidth should always be set greater than the size of the step in order to have stable operation of controls and to avoid hunting. Hence, with the same amount of desirable time tolerances (to avoid unnecessary operation), a narrower bandwidth can always be set on units having a smaller step size.

Even with holding effect, which provides assurance against undue relay contact wear and unnecessary switch operation, General Electric regulator controls can be set to hold a minimum bandwidth of between ± ¾ and ± 1 volt. Because of control accuracy—even Class 1—it is impossible for any 32-step or 16-step regulator to hold a true ± ¾-volt tolerance *on the line*. It is highly improbable that field adjustment of 16-step regulators will result in a 2- or even 3-volt tolerance *on the line* because of normal control and human inaccuracies imposed upon a 1½-volt step.

By noting the conditions common to many systems (the three charts at the left), the superiority of 32-step regulation may be seen in terms of reduced operation on average, not "selected" feeders.

The G-E ML-32 need not be untanked for inspection until after the prescribed number of operations—normally covering 20 years or more. One reason: smaller tap voltages mean less electrical wear (contact erosion) per tap change because contact erosion is approximately proportional to tap voltage. Physical wear, on the other hand, has been proven to be relatively insignificant—by test and actual field practice. Five-eighths per cent steps on the ML-32 result in less rupture voltage.

The G-E ML-32 will operate successfully under short circuits of 25 times normal *during* tap changes at any Load Bonus position. Tip life is co-ordinated with the insulation so that the oil does not have to be serviced during the life of the contacts.

Your G-E sales engineer has complete details on why G-E 32-step regulators cost less on the line. General Electric Co., Schenectady, N. Y.

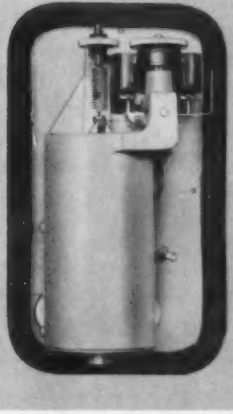
423-28

Progress Is Our Most Important Product

GENERAL ELECTRIC

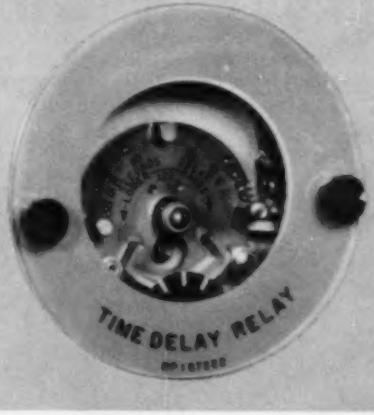
. . . *General Electric regulators cost less on the line*

ML-32 VRR WILL HOLD ± ¾ V BAND



CLOSER BANDWIDTH means savings in system operation. With the 32-step regulator, a 1½-volt band is easily set and because of time tolerances will be maintained at 2 volts or less. Attempts to hold 2 volts with a 16-step regulator could result in endless hunting.

ML-32 TDR ADJUSTABLE FROM 10–120 SECONDS

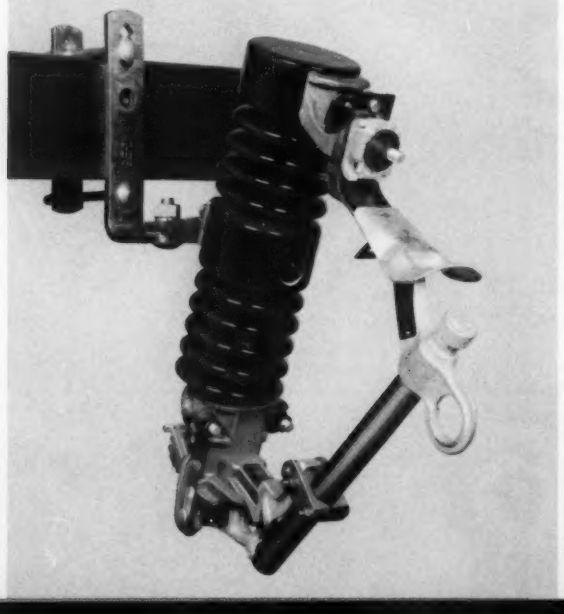


TIME DELAYS of 30 seconds are preferred by most utilities. ML-32 integrated time delay can be set *as desired* for a wide range of time delays (10-120 sec.). Result: Greater ease of control adjustment, greater operating economy, and a better *balanced* job of voltage regulation.

Extra Value in Enclosed and Open Dropout Cutouts

100-AMP ENCLOSED FUSE CUTOUT, with gas loadbreak cylinder, can now replace more expensive switching devices. As the door is opened, a high-pressure blast of insulating gas automatically extinguishes a full-load power-current arc in 3 to 7 cycles. Replacing the used cylinder is simple and can be done on the pole in moments.

10,000-AMP INTERRUPTION rating at 7.8 kv, and 8,000 amperes at 15 kv extends the usefulness of this new G-E extra-heavy-duty open dropout cutout. Double venting action of fuse tube clears high currents through expendable cap at tube top and normal venting at bottom. Low currents are cleared through optimum bore size and venting fuse tube at bottom only. Full information on the economies of cutouts are available at your General Electric Sales Office.



Free Publications on Transmission and Distribution Equipment with New Extra Values

DISTRIBUTION TRANSFORMERS

10 Reasons Why General Electric Is Your Best Transformer Buy—GEA-6070C.
Self-protected Distribution Transformers—GEA-6126B.

INSTRUMENTS

New Butyl-molded Potential Transformers—GEA-6810.
Telemetering Systems—GEA-5233.
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LIGHTNING ARRESTERS AND CUTOUTS

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Open Dropout Fuse Cutouts—GEA-1816L.
Flip Open Fuse Cutouts—GEA-4224E.

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Power Capacitors—GEA-6662.
Stack-Rack Capacitor Equipments—GEA-6796.
Pole-Top Auto-Switch Capacitors—GEA-6543.
Fixed Pole-Top Capacitor Equipments—GEA 6657.
Residential Secondary Capacitors—GEA-6670.
Protective Gaps for Positive Protection of Series Capacitors—PT-26.

MEDIUM VOLTAGE SWITCHGEAR

Metal-Clad Switchgear—GEA-5664.

FEEDER VOLTAGE REGULATORS

ML-32 Step Voltage Regulators—GEA-5752.
ML-32 Step Voltage Regulators Application Guide—GED-3468A.

POWER TRANSFORMERS

Mobile Unit Substations and Mobile Transformers—GEA-4415.

Any of the above publications may be had at no cost by writing the General Electric Co., Section 431-76, Schenectady 5, N. Y.

LIVE BETTER ELECTRICALLY

Progress Is Our Most Important Product

GENERAL ELECTRIC

"Line" Responsibility

(*Continued from page* 66)

assignment program. Here, the use of photographs, slides, and booklets detailing standard jobs, narrows the gap between training and on-the-job application to a hairline.

In groups of six or eight, supervisors of like work practice assigning work to others in the group. Following each assignment, the group discusses how the job was assigned. From these discussions, it becomes clear that work assignment is more than telling a man "to do this or that" or handing him a written order.

Another phase of management development aims at improving the ways in which work is done—the methods, procedures, tools, facilities.

Work simplification, "working smarter, not harder," is set up as an eight-session conference program in which all supervisors participate on a departmental basis. They "study the obvious," each participant analyzing jobs for which he is responsible.

The program emphasizes that work simplification is not so much a procedure as it is a frame of mind. It's simply a part of intelligent, effective supervision.

The training coordination unit of the educational division provides staff service in the nature of advice and counsel to the supervisors who are training their own people. It develops training outlines and instructional materials to be used by line organization "teachers." And it helps those teachers by teaching them how to teach.

Best Training Is On-the-Job

A studied attempt is made to keep teaching a part of the normal supervisory function. For the most part, the most fruitful training can and should be provided on the job.

In some instances, the plan of on-the-job instruction at Union Electric is formalized and supplemented by instruction provided through trade schools and universities. For example, journeymen craftsmen in maintenance trades (machinist, pipefitter, electrician) are developed through apprenticeship programs. Other skilled workers are trained in modified apprenticeship type programs where the emphasis is on on-the-job instruction, concentrated practice, and related instruction in specific theory.

IN FIRE FIGHTING course, employees learn by actually putting out fires with equipment available at their job locations. Union Electric stresses safety

Some employee training efforts involve several or all departments of the company. Here, the training coordination unit not only plans, but conducts the training. Examples are general employee information, business economics, customer relations, communications, engineer development, and employee orientation programs.

But, the "line" concept still holds. Take orientation as an example: While the orientation plan was developed and put in motion by the staff group, the heart of the program is handled by the "boss" of the new employee. Thus "orientation" helps not only to the new employee but also to the supervisor as he goes about his task of making each new person a productive and satisfied employee.

While safety is frequently related to the engineering and inspection functions, at Union Electric, the emphasis is on the educational features of accident prevention. Safety is emphasized in basic supervision, in work assignment, in engineer development, in job training and in apprenticeship programs of all types. It cuts across all manpower development efforts.

The objective, of course, is to make safety a standard operating procedure in everything we do.

The safety unit of the educational division is a staff activity. It assists the entire operating organization in many ways.

In addition to a schedule of employee safety meetings in each unit of all operating departments, the safety unit and the management safety policy committee sponsor annually an all-day safety conference. The participants are the supervisors and employee representatives responsible for conducting safety meetings. The conference could be looked upon as a refresher seminar for program planners.

Fire prevention and fire fighting receive special attention. A one-day training course is attended by people from the various departments. Refresher training is provided for fire brigade personnel and other key employees at power plants. Actual practice in extinguishing fires is an important part of this training.

Promotional and educational use is made of company and industrial awards, a special but regular series of bulletin board pieces, and regular coverage of safety items in the company newspaper and magazine.

Records are kept, statistics are assembled and interpreted, inspections and safety studies are made—but the primary activity of the safety unit's staff is to help operating people develop and conduct educational efforts to build safety knowledge, safety skill, and a safety attitude into all company activities by all company people.

All training efforts—and when one totals them for an entire company, they are many—are intended to contribute toward one or more of the following: 1. Skill that makes for effective work; 2. Knowledge that makes for intelligent application skill; 3. Attitude that makes for pleasant, productive effort.

Temperature Resistance Makes Silicone Insulations Attractive

Wire and cables so insulated keep stability in hot and cold ambients; have nuclear power plant applicability worth noting

PERRY H. WARE, Head, Standards & Technical Engineering, Simplex Wire & Cable Co, Cambridge, Mass.

Silicone-insulated wire and cable are becoming increasingly attractive to engineers engaged in designing utility and industrial installations. Such conductors resist high and low temperatures and the effects of wet and dry locations, and carry high-current loads without appreciable deterioration for relatively longer periods.

Although silicone cables cost more than other types, the cost per ampere of permissible current compares very favorably with that of other cables. And in any evaluation of the cost of a cable, all installation and service outlays should be factored in. Choice of installation should not be based solely on initial cable cost.

Resists Radiation

Silicone rubber has properties making it useful for several special applications. Its resistance to atomic radiation makes it adaptable to circuits in nuclear power plants. It is virtually corona and ozone proof, not exhibiting the rapid aging, deep cuts, and cracks usual in many natural and synthetic rubbers exposed to ionized air in high-voltage service. This important characteristic is conducive to its use for power cables over 600 v and for services where excess ozone is in the air.

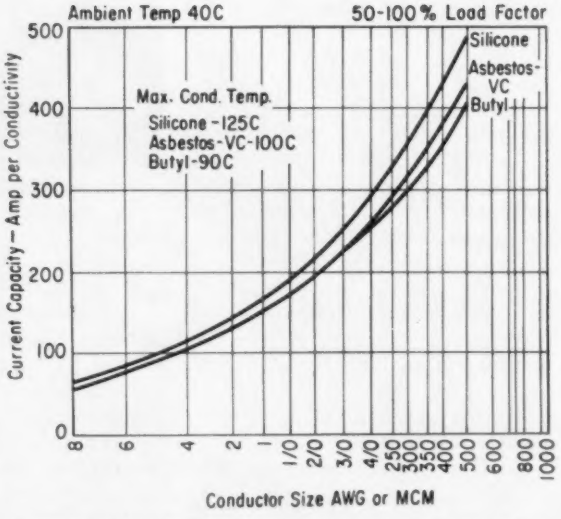
The heat resistance of silicone wire and cable has a definite advantage where the conductor itself is the souce of heat (I^2R losses) or where the heat comes from external sources. The former class of application includes installations in which, because of space, loads, or other limitations, the conductor must carry currents in excess of those permitted by conventional insulations. Load requirements increase in some places where there is no room for additional or larger cables. It is then necessary to operate conductors at higher temperature, using a heat-resistant insulation. Although conductor losses may be high, the cost of installing new duct banks or rerouting cable runs may be prohibitive or physically impracticable.

At times motor and generator leads must be installed in limited space, where large conductors are difficult to install. These circumstances, together with the heat generated in the enclosed space, make anything except a high-temperature insulation uneconomical and sometime impracticable. For wire, such as heating cables and defroster wire, which operate with hot conductors, silicone rubber has the advantages of light weight, flexibility, high-temperature rating, and ability to withstand repeated temperature changes.

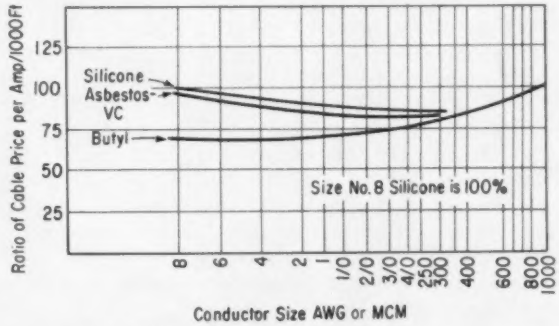
Applications are many in which cables operate in high ambient temperatures. Many manufacturing and process industries have furnaces, soaking tanks, boilers, and other heat sources. Power generating and distributing stations, boilers with high-temperature steam lines, heavily loaded apparatus, and switchboards have places where cable operates in very hot atmosphere.

A cable's current-carrying capacity is a function

(*Continued on page* 88)



CURRENT CAPACITY of three single conductors in 5-kv conduit is shown for the various wire and cable sizes



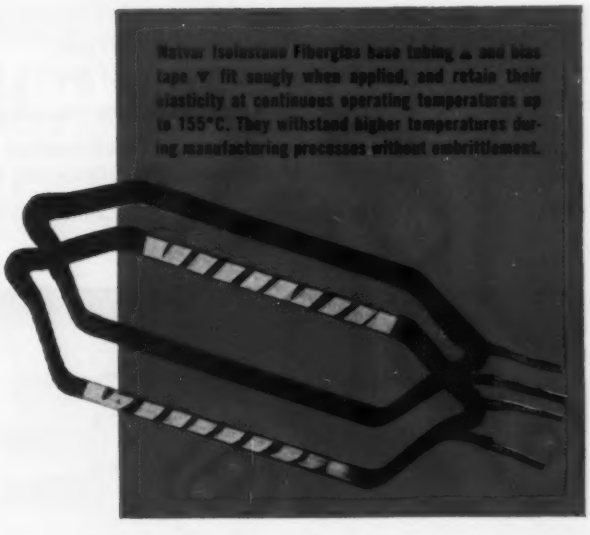
RELATIVE CABLE PRICES for single-conductor, 5,000-v cables is a ratio of cable price per amp per 1,000 ft

Adapted from a paper presented at Tenth Annual Power Distribution Conference, at University of Texas.

NATVAR ISOLASTANE* TUBING and TAPE

✓ **RESILIENT, ELASTIC** – for sharp bends and irregular surfaces

✓ **HEAT RESISTANT** —for continuous performance at temperatures up to 155°C


Natvar Isolastane Fiberglas base tubing ▲ and bias tape ▼ fit snugly when applied, and retain their elasticity at continuous operating temperatures up to 155°C. They withstand higher temperatures during manufacturing processes without embrittlement.

*ISOLASTANE *is Natvar's new elastomeric isocyanate type coating for Fiberglas braid and tape. Registration pending.*

Natvar

Natvar Products

- Varnished cambric—cloth and tape
- Varnished canvas and duck
- Varnished silk and special rayon
- Varnished—Silicone coated Fiberglas
- Varnished papers—rope and kraft
- Slot cell combinations, Aboglas®
- Isoglas® sheet and tape
- Isolastane® sheet, tape, tubing and sleeving
- Vinyl coated—varnished tubing and sleeving
- Extruded vinyl tubing and tape
- Styroflex® flexible polystyrene tape
- Extruded identification markers

Ask for Catalog No. 24

Natvar Isolastane is now making important savings possible. It makes it unnecessary to use expensive Class H materials to solve temperature problems during the manufacture of products which do not require Class H rating.

Isolastane is outstanding in its

- *ELASTICITY (EXTENSIBILITY)*
- *RESISTANCE TO HEAT*
- *RESISTANCE TO CRAZING AND CRACKING*
- *RESISTANCE TO SOLVENTS, INCLUDING THE ASKARELS*
- *TOUGHNESS AND ABRASION RESISTANCE*
- *WET DIELECTRIC STRENGTH*
- *LOW TEMPERATURE FLEXIBILITY*
- *FUNGISTATIC QUALITIES*

Full technical data and samples are available on request.

NATVAR CORPORATION

FORMERLY THE NATIONAL VARNISHED PRODUCTS CORPORATION

TELEPHONE FULTON 8-8800 — CABLE ADDRESS NATVAR: RAHWAY, N. J.

221 RANDOLPH AVENUE • WOODBRIDGE, NEW JERSEY

SILICONE RUBBER INSULATED BY ROCKBESTOS OFFER YOU:

Excellent dielectric strength — electrical properties remain constant from −130°F to +500°F.

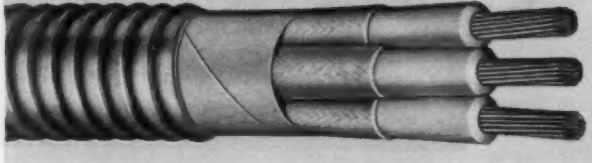
High heat resistance — better than any type rubber insulation. Long service life in temperatures to 125°C (power cables) and 200°C (other applications).

Excellent moisture resistance — unrestricted applications in wet or dry locations — equal to the best grades of rubber. No lead sheath required.

Greater ozone resistance than the best grades of rubber insulated cables.

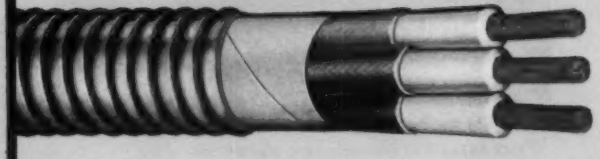
Excellent resistance to chemical attack — being chemically inert, silicone rubber insulations resist effects of lubricating oils and most corrosive atmospheres.

Long life — excellent resistance to weathering and aging.



600 and 5000 VOLT MULTI-CONDUCTOR POWER CABLE

Silicone rubber insulated power cable combined in a 3 or 4 conductor conduit, with interlocked armor overall . . . easily installed with simple supports . . . eliminates conduit . . . greater current carrying capacity for economical power distribution.



MULTI-CONDUCTOR CONTROL CABLE

For use in steel mills, power stations, boiler rooms, automotive, ceramic and glass plants as well as other industries where control and signal circuits or control equipment are exposed to high ambient operating temperatures.

ROCKBESTOS PRODUCTS CORPORATION

NEW HAVEN 4, CONNECTICUT

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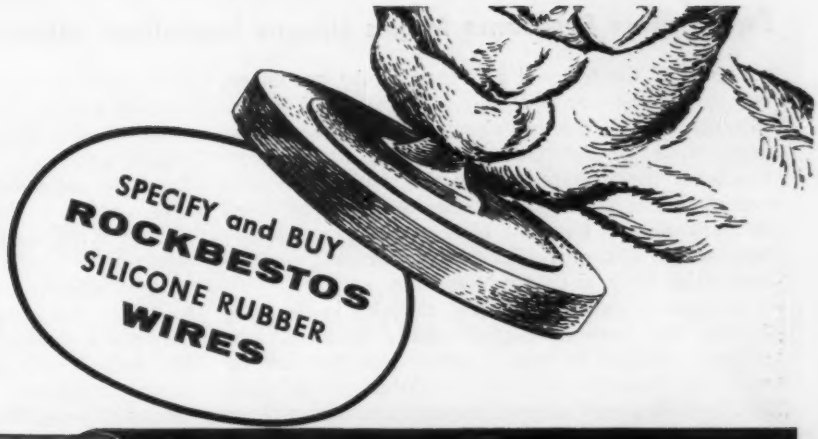
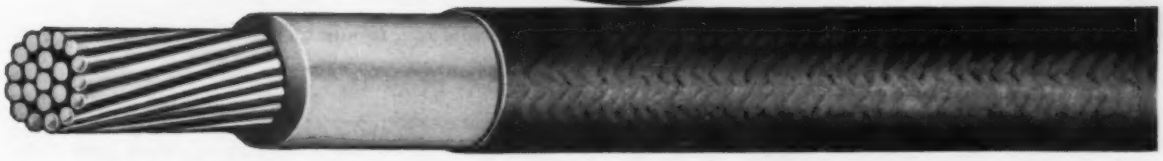
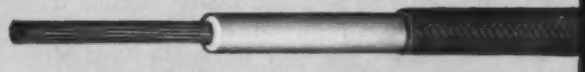
WIRES





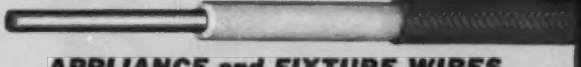
SILICONE RUBBER INSULATED POWER CABLE
600 and 5000 VOLTS

For high temperature circuits either in wet or dry locations, exposed or in conduit. This cable is recommended for use in steel mills, power stations, heat treat areas, boiler rooms, foundries, smelters, etc.



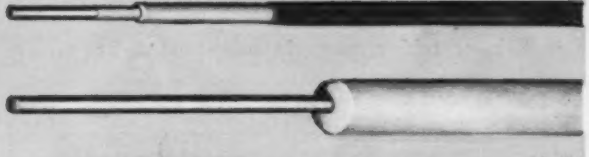
MOTOR LEAD and APPARATUS WIRES

For leads to motors, transformers, etc., requiring a flexible wire in high temperature locations or applications.



APPLIANCE and FIXTURE WIRES

For use in wiring high wattage units when operating temperatures reach 150°C and 200°C. Lighting fixtures, clothes dryers, electronic equipment, stoves, water heaters, ovens, therapeutic devices, space heaters are among the many products for which these wires are recommended.



HEATING CABLES and DEFROSTING WIRES

Heating cables are ideal for use in pipe heating, surface heating, roof de-icing and soil heating.

Defroster wires being odorless and tasteless are perfect for use as rapid defroster heating element in electric refrigerators and freezers.

ROCKBESTOS

For complete details on Rockbestos Silicone Rubber Insulated Wires and Cables send for Catalog SR58.

Temperature Resistance Makes Silicone Insulations Attractive (*Continued from page* 84)

not only of the material and area of the conductor, but also of the safe operating temperature of the insulation and the thermal circuit. Permissible current depends on the difference between the ambient and conductor temperatures. When the insulation is conventional, the temperature difference may be small in many places. Then the higher conductor temperatures which silicone rubber permits increase the current rating for a given conductor size.

Silicone rubber, a laboratory curiosity in the early 1940's, has been developed from a crumbly, low-strength material to today's rubber-like electrical insulation. Industrial and utility engineers are definitely interested in power, control, and instrumentation cables insulated with it. Silicone's use is being extended to underground distribution, power station, and industrial circuits for operations as high as 5,000 v. A few 15-kv silicone cables are in service. The development of silicone rubber as an efficient high-temperature electrical insulation is a response to the fact that modern ampacity demands higher operating temperatures.

Resists Cold Also

Natural rubber, buna, butyl, polyvinyl chloride, and polyethylene contain hydrocarbons. But silicones, as combinations of organic and inorganic substances, get their resistance to heat, cold, chemicals, and weather from silicon, an ingredient of common sand.

As there are thousands of organic or carbon-based compounds, so too there are many possible silicone compounds, ranging from oils and greases through resins and rubber-like polymers. The silicone rubber family itself has many varieties, some having particular applications in the mechanical field; others to electrical insulation.

Silicone rubber, properly compounded, has an organic nature which allows its application in temperatures of 125 to 200C, compared with the 60 to 105C range of other rubber and rubber-like materials. And silicone's other physical and electrical properties follow somewhat the same stability pattern. Besides resisting heat, silicone rubber retains its flexibility even down to —100C. Thus it can be installed and used in very cold ambients.

Early silicone rubber cables were very susceptible to failure from water absorption and could be used only where they could be fully protected from moisture. But today's cables have improved water-absorption characteristics and, may operate in wet locations where some high-temperature insulations fail.

Gives No Toxic Fumes

Exposed to a direct flame, silicone burns, forming a non-conducting ash without giving off toxic fumes. It is resistant to many chemicals. Although it is more resistant to some oils than natural, buna, and butyl rubbers, it is less so than polyvinyl chloride.

Today silicone competes with such insulating materials as asbestos and magnesium oxide for high-temperature-use cables. Silicone insulation comes as extruded silicone rubber and as glass tapes faced with silicone rubber. The extruded product has been used for cables operating as high as 5,000 v with a temperature rating of 125C. It can be used at 200C on appliance or fixture wire at lower voltage.

Consolidated Edison of New York, in 1954, made an installation of single conductor, 2,500-MCM, 15-kv generator cable insulated with silicone-glass tape and protected from moisture by a lead sheath. Because it could be operated at 125C, its current-carrying capacity in a 50C ambient was 40% higher than that of conventional cable.

Among civilian—in contrast to military—applications, power cable uses the largest quantity of silicone rubber. Extruded silicone rubber is used for cables up to 5,000-v rating, and silicone-glass tape construction up to 15 kv. Silicone lead wires give an increased factor of safety for many Class B equipment installations, such as motors and transformers.

Silicone-rubber-insulated cables in the power and control field have been made, to date, largely with copper conductors. Aluminum has not been used except in possibly special cases because its larger cross-section requires more silicone for a specified wall thickness, adding to the price of silicone-insulated cable. No connectors have been approved for aluminum at the temperatures at which silicone is used efficiently.

Silicone insulation, because of its high-temperature characteristics, is used frequently for heater, defroster, and thermocouple wires. Such conductors are of metal suited to the application, such as nickel-chromium alloys, constantan, and other alloys. For some high-temperature applications, silicone rubber over special conductors, such as nickel-clad copper and alloys, may be used. Silicone rubber can be used at temperatures that cause copper conductors to oxidize and become brittle.

Present practice limits the use of extruded silicone

(*Continued on page* 141)

TABLE I—Maximum Operating Temperatures for 5,000-V Cable Insulations

Type of Insulation	Max. Cond. Temp. —C
Oil-Based Rubber	75
Varnished Cambric	85
Butyl Rubber	90
Asbestos-VC (110C at 600 V)	100
Silicone Rubber	125

TABLE II—Maximum Conductor Temperatures for Silicone Insulated Wire and Cable

Wire and Cable Type	Recommended Max. Con. Temp. —C
Power Cable	125
Control Cable	125
Appliance and Fixture Wire	200
Apparatus Leads—Class H	200

No. 1 of a series...

the dead-ends* you never see improve the ones you buy

RESEARCH & ENGINEERING TEST SAMPLE
TYPE OF TEST: Corrosion
EQUIPMENT USED: Salt Fog Chamber
SPECIMEN NO.: 10
TEST STARTED 3/24/58 9 a.m.
TEST TERMINATED 5/23/58 2 p.m.

Most metallurgists and product design engineers are aware that laboratory corrosion tests have relatively little quantitative significance in terms of predictable service life. The only valid conclusion which may be drawn from such tests is that the particular samples tested had a certain relative resistance to the specific corrosive environment in which they were placed.

Nevertheless, corrosion proof-testing is considered an essential phase of product quality control at the Preformed Research and Engineering Center. In addition to conventional raw material quality control procedures, observations of relative corrosion rates are also made on finished products. As an example of objective performance standards used, Preformed Guy-Grip dead-ends are required to have corrosion resistance exceeding that of the strand for which they are designed. To assure compliance with these minimum quality standards, samples taken routinely from production are applied to strand specimens and exposed to a severe corrosive environment under closely controlled laboratory conditions. Periodic inspections are also made of field test specimens installed at locations throughout the country which are considered to be representative of extreme marine and industrial contamination. This constant laboratory and field surveillance has undoubtedly been largely responsible for the fact that there has never been a report of a Preformed Guy-Grip dead-end having failed in field service due to corrosion.

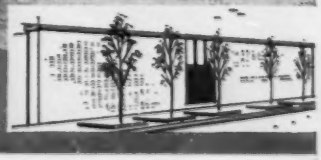
Jon R. Ruhlman, Vice President
Research and Engineering

Research and Engineering ... another reason why...

You can look up to **Preformed**

PREFORMED LINE PRODUCTS COMPANY • 5349 St. Clair Avenue, Cleveland 3, Ohio. Cable: Preformed-Cleveland ... manufacturers of armor rods, dead-ends, Guy-Grip dead-ends and other line accessories.

* Made in accordance with or for use under Patent No. 2,761,273, other patents issued and pending.



A NEW WRINKLE IN NETWORK DESIGN

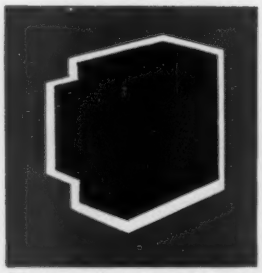
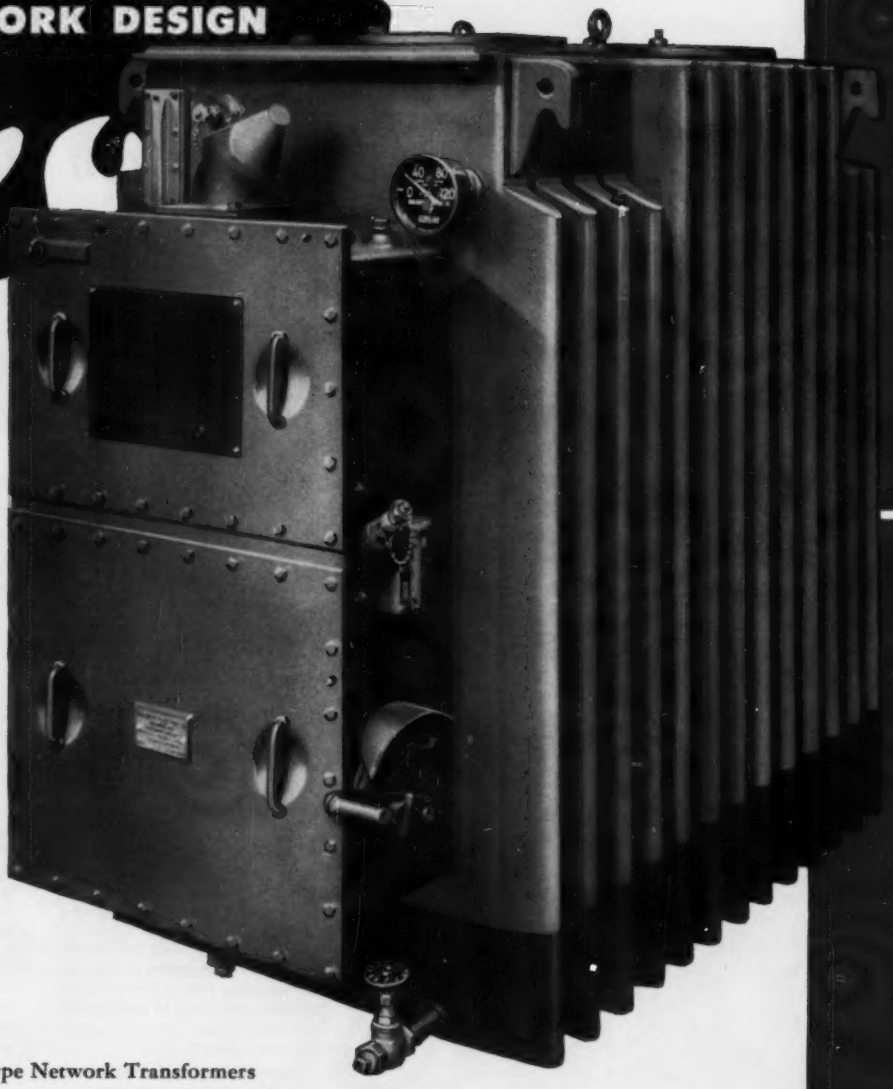


Diagram illustrates savings in space of new design as compared with older type network transformer.



Moloney Subway or Vault-Type Network Transformers with corrugated tanks are strong, rugged units developed by Moloney to answer some of the problems associated with the use of network transformers.

These units are built to conform to the EEI-NEMA Standards for Network Transformers or to conform to customers specifications.

Moloney Network Transformers offer your system the performance, dependability and trouble-free service expected of all Moloney products . . .
Specify Moloney Transformers for Quality . . . All Along The Line.

MEEB-13

MOLONEY ELECTRIC COMPANY

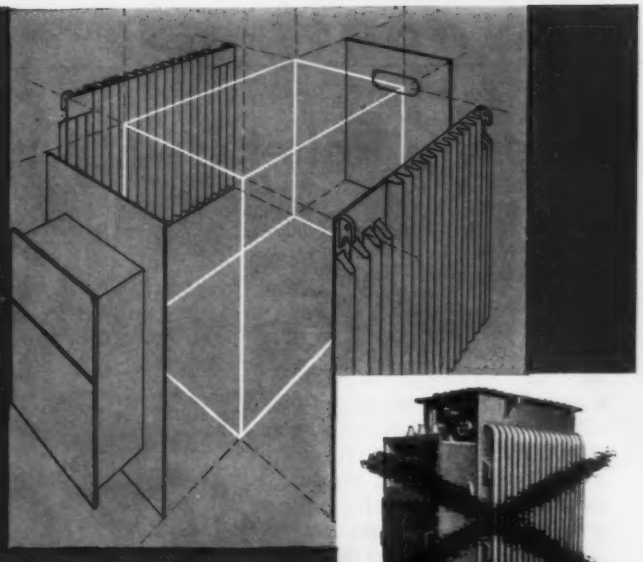
Manufacturers of Transformers for Utilities, Industry, and Electronic Applications

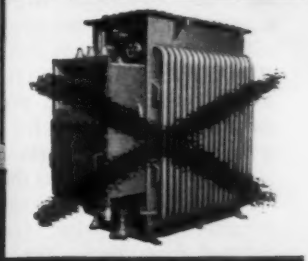
SALES OFFICES IN ALL PRINCIPAL CITIES • FACTORIES AT ST. LOUIS 20, MO. AND TORONTO, ONT., CANADA

REAL TANK CORRUGATIONS

Molded between reinforcer tank walls are easily corrugated (as shown in diagram) and are welded only at the corners.

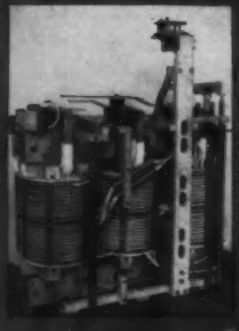
The old problems of corrosion spots and servicing accessibility are gone! now inspection, cleaning and painting is easily done from above.





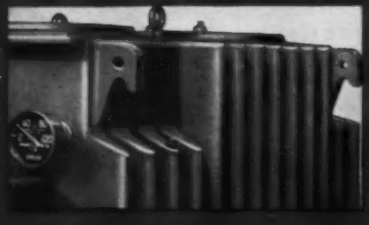
RUGGED CORE-AND-COIL UNIT

The core-and-coil assembly is a rugged, compact unit solidly blocked and framed. Every lead is adequately insulated and rigidly braced. All bus bars are supported by shed-coil insulators. The core-and-coil unit is securely fastened in its position in the tank by adjustable clamps.



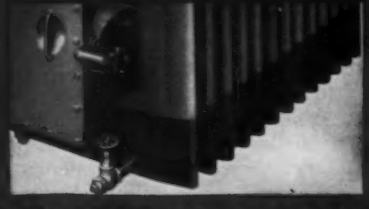
INCREASED MECHANICAL STRENGTH

Molded's ability to corrugate the steel plates of the transformer tank wall produces a tank of inherently greater mechanical strength, thereby eliminating the need for stays between



SEALED AGAINST MOISTURE

Tank covers molded accurately and smoothly, thereby sealing the tank against the entrance of moisture.



UNDERCOATING OF TANK BASE AND LOWER TANK WALLS

Maximum protection against rust and corrosion is obtained by the application of protective undercoating extending up the tank walls to a point above the normal level of submersion.

Pressure Relief Device Has Reseal Feature

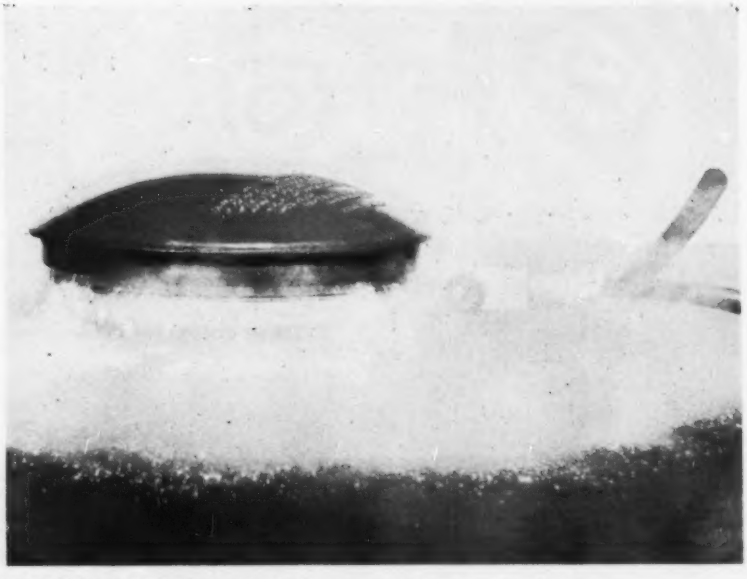
M. ARONSON, Mechanical Engineer, Pennsylvania Transformer Div, McGraw-Edison Co, Canonsburg, Pa.

A mechanical pressure valve which is actuated by a preset spring has been developed to eliminate many of the disadvantages of other relief methods. The device completely reseals when a pressure of one-half the operating pressure is reached. It is suitable for oil, gas, or askarel filled compartments.

Pressure is relieved by the vertical movement of the cover against the pressure of the spring. Gas is discharged from under the cover as seen in the photograph.

The relief cover consists of "primary" and "secondary" areas. When the pressure in the apparatus to which it is attached exceeds the predetermined spring force acting on the cover, the pressure, initially confined to the "primary" area, escapes to the "secondary" area, lifts the cover and escapes past the outer sealing gasket. Upon completing its operation, the device reseals and requires no manual resetting or replacement of parts for subsequent pressure relief operations. When a combination alarm switch and visible indicator arm is provided, it is necessary only to rotate the indicator arm to its original position with a hot stick. This also serves to reset the alarm.

The force to which the spring is initially tightened or compressed determines the operating or "blow-off" pressure of the relief valve. The spring is tightened to exert a force that is transmitted from the shaft to the cover. The increasing gas pressure confined to the "primary" area of the cover by the inner gasket relieves the metal to metal contact force between cover and flange and overcomes the frictional drag of the gaskets. Cover movement or flexing during pressure variations below the valve operating pressure has been eliminated, because the maximum movement that can occur prior to blow-off is the infinitesimal amount required to separate cover and flange mating surfaces.



PRESSURE RELIEF DEVICE discharges carbon dioxide during an acceptance test. The indicator arm has been flung back and the alarm has sounded

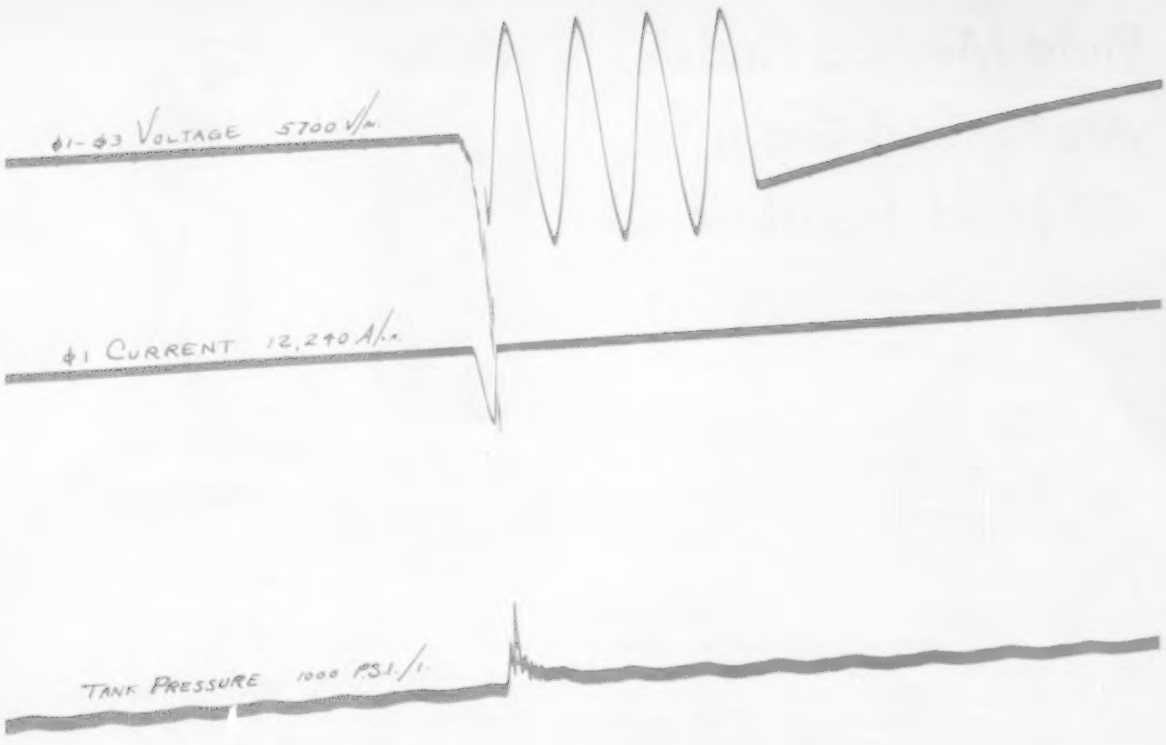
When the "blow-off" setting of the valve is exceeded, the spring force is overcome and the cover rises slightly to allow the initially confined pressure to leak into the "secondary" area. This immediately multiplies the force acting on the cover and lifts it violently to its full open position, allowing the pressure to escape past the outer sealing gasket to the atmosphere.

Normal accuracy of the relief valve is within ±10% of the predetermined pressure setting. The wide operational range permits factory adjustments of the setting to be coordinated with the various methods of oil preservation systems used. The operating pressure of the valve is set between 1½ and 3 psi above the maximum operating pressure of the system. The pressure setting and the compressed spring length necessary to obtain this setting is permanently embossed on the relief cover.

The self-resetting feature eliminates the need for de-energizing the transformer to replace parts or reset the device. This is advantageous following "false" operation of the valve as may occur from a rapid pressure rise caused by improper filling of gas or liquid tanks or compartments during installation or maintenance. Because operation of the valve prevents air and water from entering the transformer, it cannot contribute towards secondary explosions or fires.

Tests are being conducted to determine the performance of the valve while submerged under a head of liquid. Tests thus far indicate that the valve will operate and reseal without exposing the "primary" area or pressure side of the valve to moisture when submerged under 3 ft of water.

(*More How To on page* 94)



TESTS SHOW EXTRA INTERRUPTING CAPACITY FOR THE G&W FC42 OIL FUSE CUTOUT

interrupting capactity 12,000 amps. asymmetrical - 2.5kv, 200 amps.

extra interrupting capacity 16,000 amps. asymmetrical - 2.5kv, when fused at 100 amperes or less

This cutout can be used where there is an available fault current of 16,000 amperes (asymmetrical) provided that a fuse link rated 100 amperes or less is used. The application rating of 16,000 amperes at 2,500 volts is made possible by the current-limiting action caused by the fuse melting before the current can reach peak value. The fuse melts in only a fraction of the first half of the cycle of fault current and limits the current to a relatively small value.

Investigate the possibilities of using the FC42 in place of more expensive protective equipment. Consider, also, its use for sectionalizing circuits under load. A linkage readily adapts multiples of the cutout to gang operation for use as multi-pole oil switches. A G & W representative will be glad to help you.

G&W ELECTRIC SPECIALTY COMPANY
3500 W. 127TH STREET • BLUE ISLAND • ILLINOIS
CANADIAN MFR.-POWERLITE DEVICES, LTD.-TORONTO, MONTREAL & VANCOUVER
C581

Field Method Finds Arc-formed Gas in Oil-filled Transformers

D. HARRISON, Chemical Research, Hydro-Electric Power Commission of Ontario, Toronto, Ontario

A reliable and satisfactory field method for detecting arc-formed gas in oil-filled transformers has been developed by the research division of the Hydro-Electric Power Commission of Ontario. Accurate results with the method can be obtained in 10-15 min by regular maintenance personnel, who need not be specialists in gas analysis.

The method uses a glass testing tube containing potassium permanganate in silica gel, through which a sample of transformer gas is passed. Unsaturated hydrocarbons, formed during decomposition of the oil and present in the gas, will produce a readily visible color change (positive reaction) in the permanganate from purple to brown. Gas produced by the overheating of electrical insulation, however, may not give a positive reaction because of the very low concentration of unsaturated hydrocarbons.

The permanganate method is more advantageous than a flame test, which is unreliable and hazardous. The method does not require that personnel be specially trained, as is necessary for the two-solution silver nitrate test. A method for the detection of carbon monoxide was tried, but was found unsatisfactory because it gave a positive reaction with air having been in prolonged contact with transformer oil.

Thorough laboratory testing and preliminary field use preceded development of the permanganate method in this final form. The testing device for the method consists of a glass tube containing the purple permanganate indicator, with purified silica gel and glass cloth packing at each end.

A gas sample of about 60 cc from the transformer is passed by displacement of transformer oil through a gas testing tube from which the tips have been broken. Prior to the test, the gas is collected in a glass bottle fitted with a two-holed stopper and two pieces of copper tubing. The container, stopper, and rubber tubing, which form a gas collecting kit, are packed in a cardboard mailing carton. Kits are used for testing at the transformer and for shipping gas samples to the laboratory for confirmation of field findings when necessary.

To facilitate field testing, most gas-detector relays on Ontario Hydro's transformers have been modified by the addition of copper or brass tubing which permits the bleeder valve to be placed at a convenient height.

Tests have shown that unbroken testing tubes will remain in a satisfactory condition for 16 months when stored in the dark. Under direct exposure to strong daylight, the permanganate indicator will turn from purple to brown in 2-6 weeks. Preparation of the tubes in either daylight or artificial light, however, has no adverse effect on the keeping qualities.

GAS COLLECTING KIT consists of glass container, stopper, and tubing. Transformer gas passed through the testing tube will turn the indicator brown if arc-formed gas is present

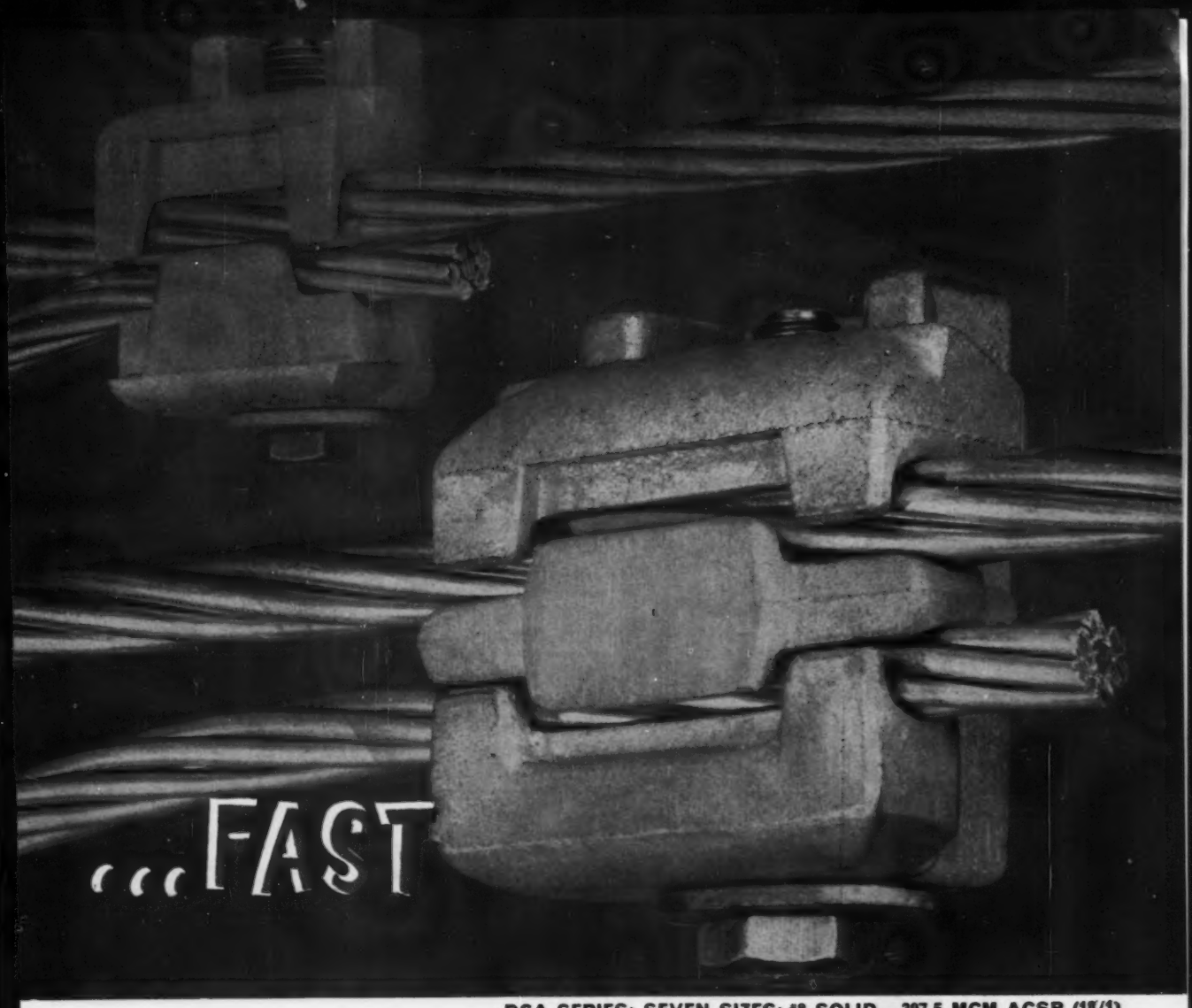
Two factors that affect the sensitivity of the testing tube method are the concentration of unsaturated hydrocarbons and ambient temperature at time of testing. At 75F the tube will give a positive reaction in 1 min for concentrations of 0.1% or more.

Sensitivity will decrease with temperature; at —15F it takes 20 min for a positive reaction with a 0.25% concentration. Below —35F a positive test may not be obtained; however, exposing the cold tube to a 70F ambient for a few minutes will produce a color change with no subsequent addition of gas.

Of 36 tests made in the field, 29 indicated a negative reaction (no combustible gases) and five positive. These findings were later confirmed by laboratory tests. In the first of two doubtful tests, only half of the indicator changed color, even after about 200 cc of gas was passed through the tube. After a poor connection on an off-load tap-changing switch was adjusted, no further gassing in the transformer occurred.

In the second case, only one of three testing tubes gave even a doubtful positive reaction. Anaylsis of each sample revealed traces of hydrogen and carbon monoxide. But examination of the transformer did not turn up any electrical fault and the reason for the gassing remains unexplained.

(*More How To on page* 98)



DGA SERIES: SEVEN SIZES: #8 SOLID—397.5 MCM ACSR (18/1)

One Piece Construction: Makes for fast installation. Just hook on the Main, insert Tap and tighten!

High Conductivity Spacer: Anderson's soft, pure, aluminum Cover-All Spacer assures additional contact with individual strands. Spacer design material and massive construction combine to provide cool running, long-life contacts.

Extended Spacer for Easy Application: Whether applying the DGA on "hot" or "dead," the Spacer can easily be picked up for Tap insertion.

Positive Interlocked Upper and Lower Grooves: Main and Tap groove alignment is maintained by interlocked casting bodies, thus aiding installation and improving contact efficiency.

Pre-Inhibited: All DGA connectors with spacers are chemically cleaned and inhibited at the factory. Contact resistance is greatly reduced and maintained by Anderson's exclusive inhibitor coating process. Gives corrosion protection without surface greasiness or tackiness.

Kleen-Seel: At slightly additional cost all DGA connectors will be delivered with grooves inhibitor-packed and the connectors sealed in polyethylene bags.

ANDERSON ELECTRIC CORPORATION
Birmingham 1, Alabama

Export Representative: International Standard Electric Corp.

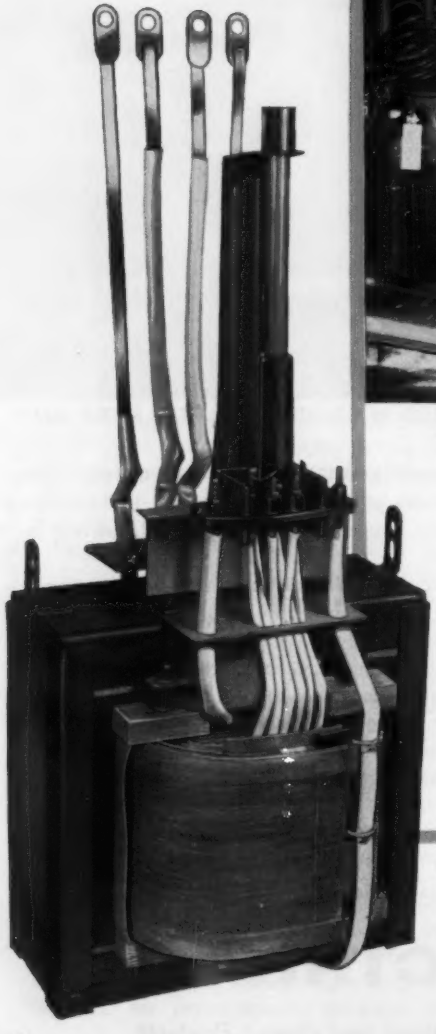
ANDERSON ELECTRIC

Research / Quality / Performance / in Aluminum and Bronze Products

Aluminum and Bronze Power Connectors • Clamps • Fittings • Accessories for SUBSTATION • TRANSMISSION • DISTRIBUTION

WAGNER FORM W TRANSFORMERS

Here is a portion of Wagner's distribution transformer plant. Wagner has been building transformers since 1893, and today's Form W Transformers bring you the benefits of the experience gained during those 65 years.



Wagner Form W Construction makes the difference

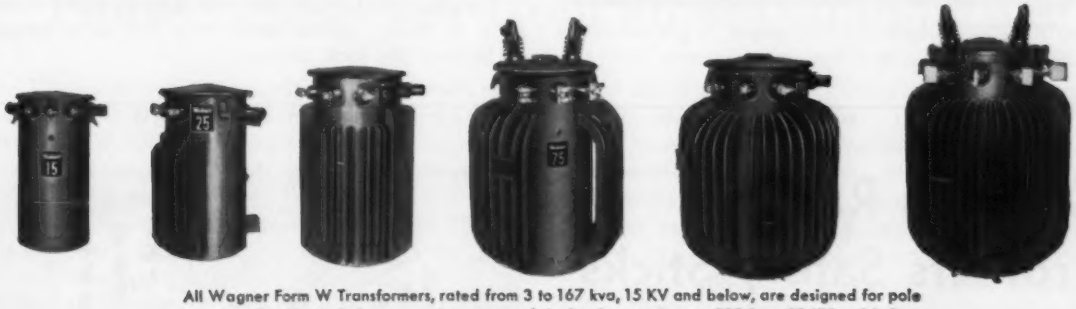
The Form W design, with oriented grain transformer steel cores, specially annealed for lowest possible magnetic losses, permits smaller and lighter elements that give excellent electrical performance with high overload capacity for peak loads. Get the full story—ask for Bulletin TU-141.

ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES • AUTOMOTIVE BRAKE SYSTEMS—AIR AND HYDRAULIC

Small in size...
light in weight... *BUT*
LIBERALLY DESIGNED
TO GIVE YOU MANY
YEARS OF TROUBLEFREE
SERVICE!

Form W Cores are cut into two turn sections and are assembled through and around the pure copper wire coils.

Form W Transformers are given all prescribed commercial tests and production line impulse tests to meet Wagner's standards for uniformly high quality.



All Wagner Form W Transformers, rated from 3 to 167 kva, 15 KV and below, are designed for pole mounting. The line includes a complete range of single-phase ratings to 500 kva, 69 KV and below.

WT38-13

Wagner Electric Corporation

6456 PLYMOUTH AVENUE, ST. LOUIS 14, MISSOURI

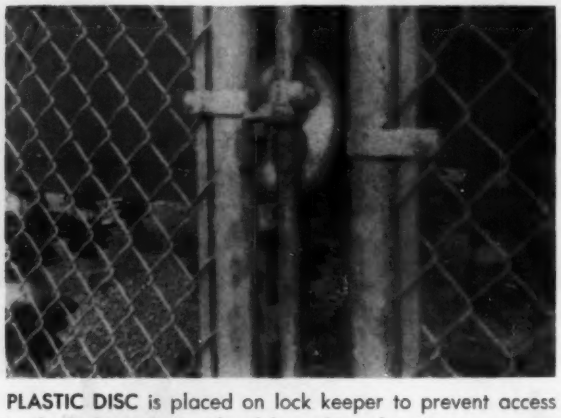
Two Layer Rubber Gloves Promote Safety

A. R. JONES, Test Engineer, Long Island Lighting Company, Hicksville, New York

A two-layer rubber lineman's glove facilitates visual inspection for cracks, cuts, or abrasions. The glove is made according to the manufacturer's standard dipping process with the inner layer light red or brown and the outer layer black. The two-color glove resulted from a request by Long Island Lighting Co to use this method of manufacturing to insure greater safety.

It is designed with the same specifications as standard gloves except that the outer 0.008 in. is a different color than the inner layer. The inspector or lineman may easily locate any cut or crack deeper than 8 mils. Any cut which does not show the inner color assures a glove still usable by a good margin of safety. Deeper cuts showing the inner color means that the glove so damaged must be immediately replaced.

"Inside" Gate Lock Reduces Hazard



PLASTIC DISC is placed on lock keeper to prevent access to the lock on the inside of fenced-in substation area

L. A. VAN FOSSEN, Asst Substation Supt, Florida Power Corp, St. Petersburg, Fla.

A new practice for locking gates in fences enclosing substation capacitor banks provides greater safety for Florida Power Corp's personnel. Gates are now installed with the locks on the inside. To further obstruct the unlocking of a gate, a plastic disc is placed on the lock keeper between the padlock and operating rod.

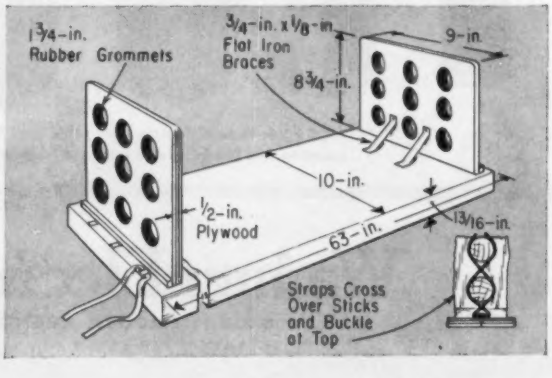
This safety practice was designed to prevent unauthorized employees from entering the fenced-in area around high-voltage capacitor banks. Entrance to the area should be through the control house. From the inside the gate can be readily opened.

The clear plastic disc measures 6 in. in diameter and is ¼ in. thick. In the center is a hole large enough to fit over the lock keeper.

Carrying Rack Protects Safety Sticks

ALLAN H. SCOTT, New England Power Co, Shelburne Falls, Mass.

Safety extension sticks may be carried or stored without damage to the varnished finish by using a convenient rack. Sticks are seated in 1¾-in. holes provided with soft rubber grommets. As many as nine sticks are held in place by straps. The center top stick is used as a handle to carry the rack.



Pioneering power from an uncommon fuel

Producing power profitably on a large-scale, commercial basis from delayed refinery coke has been accomplished for the first time on the East Coast at the new Yorktown Station of the Virginia Electric & Power Company.

This pioneering steam power plant burns delayed coke, which is economically available from the neighboring refinery of American Oil Company, supplemented by bituminous coal and refinery gas. Today, out of its initial 150,000 kw capacity, the Yorktown Station fulfills the refinery's electric power needs . . . and brings significant operational savings to both the utility and the oil company.

Stone & Webster Engineering Corporation was associated with this power station project from its inception — through the negotiations between the utility and the refinery and the design and construction — to its commercial operation, and is presently engaged on the installation of the second 150,000 kw unit.

Stone & Webster's skill and experience is available to you anywhere in the world . . . for a single phase or for full responsibility for the completion of your project.

STONE & WEBSTER ENGINEERING CORPORATION

A SUBSIDIARY OF STONE & WEBSTER, INC.

New York Boston Chicago Pittsburgh Houston San Francisco Los Angeles Seattle Toronto

Manufacturers News

Dossert Broadens UG Connector Line

A complete line of over 1,000 different sizes and types of underground connectors is now being produced by the Dossert Manufacturing Corp, Brooklyn, N. Y. Shown examining some of the more popular types of fittings are Charles A. Martin, president, (left) and Alfred B. Gunthel, Jr., chief engineer.

The items are basically pre-insulated connectors such as the basic Micon multiple outlet connectors, Micon stud connectors, crabs, limiters, fusible components, insulating sleeves and splices. In addition, Dossert is manufacturing all accessories and components for these basic fittings.

The fully molded insulation feature of these connectors is specially compounded to have exceptional dielectric and aging properties, according to the manufacturer. All connectors are fully interchangeable and conform wherever possible to dimensional standards established by public utilities. These fittings are designed for use on underground distribution networks and industrial wiring applications.

Insulation Application Meeting to be Held Sept. 3

The First National Conference on the Application of Electrical Insulation is scheduled to be held at the Pick-Carter Hotel, Cleveland, on Sept. 3, 4, and 5. The first of its kind held in the United States, it is co-sponsored by American Institute of Electrical Engineers and National Electrical Manufacturers Association.

Program Chairman, H. H. Chapman, Jr., of Owens-Corning-Fiberglass Corp, New York, said that a total of 130 technical papers have been accepted for presentation on rotating equipment, transformers, controls and instrumentation, and electronics. More than 1500 persons are expected to attend.

Dr. L. J. Berberich, Westinghouse Electric Corp, and K. N. Mathes, General Electric Co, will be speakers at the dinner meeting (Wednesday) of the AIEE Committee on Electrical Insulation.

The "Distribution Factors" dinner meeting (same evening) is for salesmen, manufacturers representatives, distributors and other interested persons. Speakers will be C. F. Bower, president of Tri-State Supply Co; H. K. Collins, vice president and general manager of Continental-Diamond-Fibre Co; A. S. Gray, president of Insulation Manufacturers Corp; and W. R. Toward, manager of purchases, Machine Div, Lincoln Electric Co.

CE to Supply Eighth Boiler to VEPCO

A $5-million contract for a 200-Mw controlled-circulation boiler has been awarded to Combustion Engineering Inc, New York, by Virginia Electric & Power Co. The boiler is to be installed in the utility's Possum Point Station located on the Potomac River at Quantico, Va.

VEPCO purchased the first controlled-circulation boiler from Combustion Engineering. This unit just ordered will be the eighth and largest boiler on the company's system.

DID YOU KNOW . . .

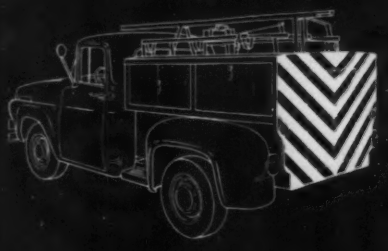
. . . either 120 or 123 v may be chosen as the nominal secondary voltage on installations of Line Material Industries' self-regulating distribution transformers. A. R. Waehner, director of transformer sales, said the high voltage setting will provide additional compensation for voltage losses in secondary distribution and consumer's service drops.

. . . by casting open-type motor stators in an epoxy resin, Allis-Chalmers Mfg Co provides for complete protection of the insulating system. This application is an addition to their Super-Seal line. The epoxy system can reportedly be used at a considerable savings in initial motor investment. Encapsulation will be available soon in integral horsepower frame sizes in which random wound coils are used.

. . . a catalog featuring a loose-leaf format will be issued shortly covering Marcus Transformer Co's line of dry, oil and askarel-immersed transformers through 5,000 kva. Copies may be reserved by calling the local Marcus representative or writing Marcus National Sales Section, Box 551, Rahway, N. J.

. . . a truck body can be lowered to the ground over a manhole and, through a door in the truck's floor, access is gained to the underground work area. This hydraulic Leveloder is a product of Thompson Tractor Corp, Pikesville, Md. It provides protection for men working underground. This Jeep-mounted body can be raised to 52 in. for platform loading.

(*More MN on page* 102)



reflective markings end danger after dark

Where there is danger, colorful markings of bright "Scotchlite" Reflective Sheeting flash a vivid warning to nighttime motorists. These durable, low-cost markings protect your own equipment, too. You show your concern for public safety. And you remind the public of your vital 24-hour-a-day service. Send for informative free booklet today.

REG. U.S. PAT. OFF.

SCOTCHLITE

BRAND

REFLECTIVE SHEETING

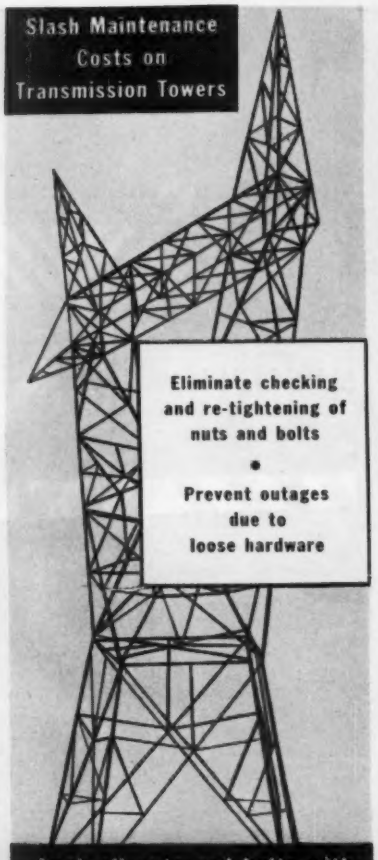
MINNESOTA MINING AND MANUFACTURING COMPANY
where RESEARCH is the key to tomorrow

PRODUCT OF 3M COMPANY RESEARCH

The term "Scotchlite" is a registered 3M Company trademark

FOR **FREE** BOOKLET ON REFLECTIVE MARKINGS, WRITE 3M COMPANY, DEPT. QW-848, ST. PAUL 6, MINNESOTA

Slash Maintenance Costs on Transmission Towers



Eliminate checking and re-tightening of nuts and bolts

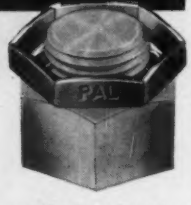
•

Prevent outages due to loose hardware

Lock all nuts and bolts with

PALNUT® LOCK NUTS

Applied in seconds— Stay tight for life!



PALNUT Lock Nuts are the lowest-cost, most reliable method of assuring permanently tight tower bolts, for these reasons:

- **Vibration-proof.** Unfailing double-locking spring action holds assemblies to original tightness.
- **Easy, fast assembly.** Light in weight, easily carried, free-spinning, quickly locked with ¼ to ½ turn of linesmen's wrench.
- **Weatherproof.** Heavily galvanized to equal or exceed ASTM specs. Still perfect after 30 years' service on many towers.
- **Low cost.** PALNUTS cost a trifle more than one cent in average sizes.
- **Small space.** Need only 3 bolt threads.

Specify PALNUTS on all new towers —add them to existing towers. Send for Free Samples and data.

THE PALNUT COMPANY

51 Glen Road Mountainside, N. J.

Mylar Rope Serves Long Pull of Cables

Rope stranded from Mylar is credited with solving a problem of a long pull of conductors through conduit. The rope, furnished by U. S. Plastic Rope Inc, Redwood City, Calif., was used by R. C. Electric Co, same city.

On a recent project four 500 Mcm cables weighing more than 1,200 lb were pulled through 162-ft length of 4-in. conduit with a Mylar rope only ⅜-in. diam. An electric winch (shown) provided the pulling power.

The conduit, through which the four RHW cables had to be pulled, contained one 90-deg bend and two offsets. First 100 ft was Orangeburg pipe and the remaining 62 ft was galvanized.

A ⅜-in. conventional 3-strand rope of Mylar was selected because of its strength. In addition it is said to have retained its handling characteristics, had no stretch factor, and did not damage the conduit.

Federal Pacific Acquires Toronto Licensee

Federal Pacific Electric Co, Newark, N. J., has acquired all outstanding stock of a former licensee, Federal Pacific Mfg Co of Toronto, according to T. M. Cole, chief executive officer of the Newark firm. He said this is an introductory step in a planned overseas expansion program.

Outstanding stock of the Canadian firm was acquired in exchange for 50,600 shares of the American Company's common stock. A. G. Daley, general manager, will direct the operations of the subsidiary.

R&IE Develops Control for Interrupter Switch

A low cost system for remote or automatic control of its HPL-C metal enclosed interrupter switches has been developed by R&IE Equipment Division, I-T-E Circuit Breaker Co., Greensburg, Pa. Employing positive pneumatic switch actuation, the new system can be incorporated on the line of HPL-C switches from 600 through 2,000 amp and 2.4 through 14.4 kv.

The system consists of a double-acting air motor, linkages, solenoid valve, and air cylinder. Three principal types of operation are permitted: Remote pushbutton control; automatic throwover schemes; and circuit opening on overload with thermal or overload relay sensing.

Motorola To Supply Nine-Station Microwave System

Motorola Communications & Electronics, Inc, Chicago, Ill., has contracted with the Pacific Gas & Electric Co, San Francisco, Calif., for a nine-station microwave system to be located in the Feather River area of Northern California.

The system, to be completed in the Fall this year, has eight large

(*Continued from page* 104)

DEEP DEEP GROUNDING

INSURES EXTRA PROTECTION

• Heat treated, alloy steel driving stud resists mushrooming — can be used over and over. Couplings of rugged Silicon Bronze.
• Completely machined point speeds driving. All rod sections are threaded on both ends for use as top, intermediate or bottom section.
Permanently Moist Soil

Blackburn Sectional Rods Get Down Into The Permanently Moist Soil

Drive down to permanently moist soil that gives lower earth to rod resistance. Actual experience shows a few dollars invested in deep grounding has saved thousands of dollars in overhead burn-outs.

- **BLACKBURN** Sectional Rods have a uniform coating of highly conductive corrosion-resistant copper, molecularly bonded to *rigid steel core.*
- Driving studs and couplings interchangeable with all standard sectional ground rods.
- Available through Electrical Distributors.

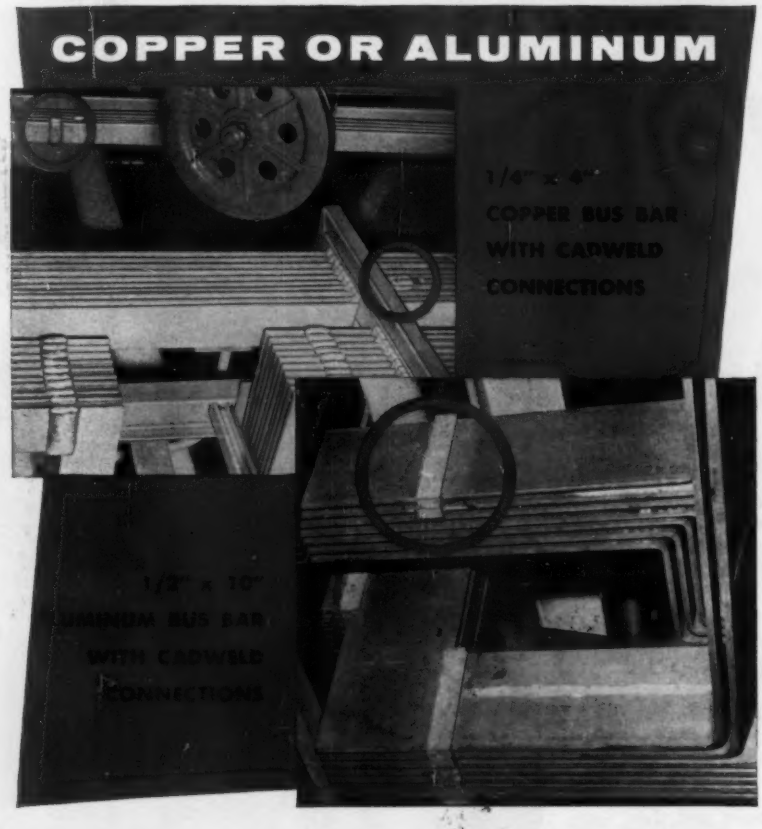
JASPER BLACKBURN CORPORATION
1525 Woodson Rd., St. Louis 14, Mo.
WYdown 3-9430

BLACKBURN *Sectional* COPPER BONDED **GROUND RODS**

Distributed on the West coast by KORTICK MFG. CO.

BUS BAR CONNECTIONS

COPPER OR ALUMINUM



Cadweld Connections on Copper or Aluminum Bus Bar Offer 5 Major Advantages

1. Random length bus can be used – reduces original material cost.
2. Weld size permits stacking of multiple runs, while maintaining proper spacing.
3. Reduced labor – individual fabrication of multiple runs permits easy handling of lightweight single sections.
4. Connections are permanent – not subject to loosening, corrosion or overload damage.
5. Newest CADWELD A-22 Aluminum welding alloy permits welding of transition joints of copper to aluminum.

CADWELD®

Erico Products, Inc.

2070 E. 61st Place Cleveland 3, Ohio

IN CANADA: ERICO INCORPORATED, 3571 Dundas St., West, Toronto 9, Ontario

passive repeater reflectors used to link the microwave terminal stations, located in narrow deep canyons, to the microwave repeater stations forming the connecting route.

The system will provide telemetering, control, transfer trip protective relaying, and telephone communication for six hydro-electric powerhouses with a total generation capacity of 506,000 kw.

MANUFACTURERS BRIEFS

General Cable Corp, N. Y., reports that its Type MI mineral-insulated cable with special Type H explosion-proof fittings has been accorded recognition for use in hazardous locations by interim amendment of the National Electrical Code. The latest approval contemplates a maximum operating temperature of 85 C (185 F).

Raybestos-Manhattan Inc, Adhesive Dept, Bridgeport, Conn., has a line of four resins for casting, encapsulating, and potting applications. These epoxies in the Ray-BOND system are designated R-86006, 86007, 86008, and 86010. Their range covers long to short pot life, curing at room and elevated temperatures and being suitable for use as Class O, A and B insulators.

Barbour-Stockwell Co, Cambridge, Mass., has sold its instrument division "Reliance Line" of tachometers, adapters, gear boxes, flexible shafts and clutches to the Curtis-Marble Machine Co, Worcester, Mass. At present, production of these instruments will continue at the Cambridge, Mass., plant.

ISA—Instrument Society of America is sponsoring the 1958 Annual Instrument—Automation Conference and Exhibit to be held at Convention Hall in Philadelphia on September 14-19. Over 400 exhibitors will have space at the show.

Sun Electric Corp, Chicago, has acquired the manufacturing facilities and product line of the panel instrument department of Texas Instruments Inc, Dallas, Texas.

Before and after tree trimming!

You're absolutely right! There's *no* difference in the pictures. That's our point.

Anaconda Heavy Line Wire almost does away with tree pruning – saves you money. At the same time it gives you greater freedom from faults!

The reason? This line wire is made with a tough thermoplastic covering with *high resistance* to moisture, weathering and abrasion. It protects conductors from contact with wet and broken limbs – from damage caused by wind, rain, sleet and snow.

Covering consists either of rugged polyethylene or time-tested Anaconda Densheath* vinyl resin compound. Conductors are supplied in copper, aluminum, or ACSR.

New bulletin DM-5705 contains full tabular data, plus information on sag and tension charts. See the Man from Anaconda for your copy. Or write: Anaconda Wire & Cable Company, 25 Broadway, New York 4, New York.

*Reg. U.S. Pat. Off. 58393

SEE THE MAN FROM **ANACONDA®**
FOR **HEAVY LINE WIRE**

LIVE BETTER ELECTRICALLY

Main work-aisle at the East Pittsburgh plant shows the extensive area available for building breakers to meet the demands of rapid system expansion in progress today. At rear is high-voltage test equipment to hi-pot complete breakers and components.

Tank interior reveals the ready accessibility of interrupter grids for inspection or maintenance. Without removing grids from bushing, interrupter blocks can be removed to reveal stationary fingers and moving contacts. Contacts can be replaced in tubes without loss of interrupter alignment.

HIGHER INTERRUPTING CAPACITIES THROUGH WESTINGHOUSE CIRCUIT BREAKER DEVELOPMENT

The outstanding protection provided by today's power circuit breakers is a primary factor in the growing load-carrying ability of modern electric utility systems. Their increased interrupting capacities, higher voltage ratings, faster operating time and improved electrical design all permit increased system capacities, greater system integration.

Every major advance in the art of circuit interruption during the past 50 years has originated at Westinghouse . . . result of a policy of reinvesting earnings into research and development. Here are a few important breaker design contributions:

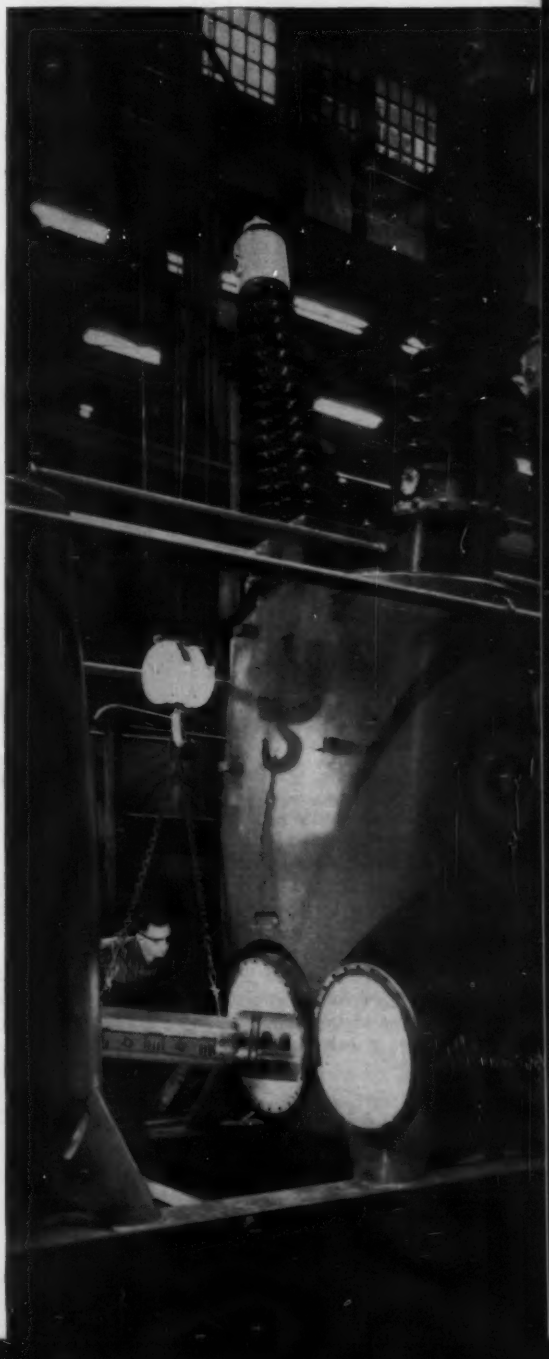
DE-ION® TUBULAR GRIDS — providing the highest interrupting capacities and most reliable operation in all voltage ranges. In addition, these grids allow the easiest interrupter inspection and maintenance possible today.

WATCH-CASE® TANKS — permitting higher voltage and interrupting ratings without a proportional increase in space. Oil requirements reduced as much as one-half with corresponding cut in maintenance costs.

CONDENSER BUSHINGS — developed over 50 years ago by Westinghouse and recently adopted by the entire industry, have proved to be the most reliable and trouble-free bushings ever designed.

Developments such as these are part of a continuing program of research and development which keeps Westinghouse ahead of your system requirements.

When planning expansion of your system capacity, call your Westinghouse sales engineer to learn how you can reduce total system investment, operating and maintenance costs. Or, write Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pennsylvania. J-60955



YOU CAN BE SURE...IF IT'S Westinghouse

TOUGH!

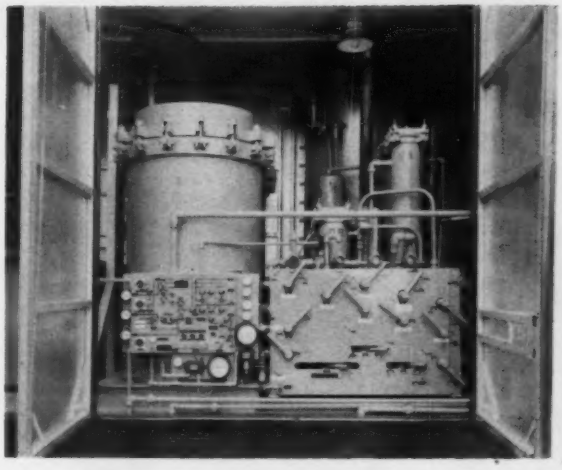
Husky Herman is getting nowhere fast. He ought to know it takes a lot of doing to damage one of VICTOR'S Apparatus Insulators!

Here's why: They are designed to withstand steep front wave impulse in addition to the normal 1.5 x 40 standard impulse. They are manufactured and tested with the industry's most modern equipment. They're made of Purified Porcelain—toughest, most durable porcelain ever made. Scientifically fitted glaze, properly and uniformly applied, gives maximum strength and protection against contamination. Precision manufacture and accurate alignment of shells, cap and pin in tempered, cast-iron jigs produce an accuracy that makes stacking fast and easy. Joining of component parts with premium grade insulator cement gives maximum tension, torsional and cantilever strength. Vigorous high frequency and 60-cycle flashover tests follow routine mechanical tests on every unit.

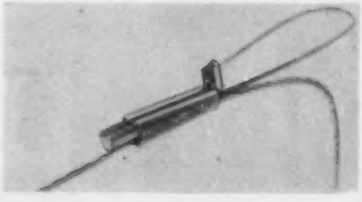
VICTOR No. 729 Apparatus Insulators are tough, dimensionally accurate, give exceptional service. Insist on highest quality. Insist on VICTOR.

I-T-E CIRCUIT BREAKER COMPANY, INC.
VICTOR INSULATORS DIVISION
Victor, New York

Oil Reclaimer . . .



. . . purifies transformer insulating oils in the field. It removes water, sludge, acids and other oxidation products, dissolved paint, bushing compound, metallic soap, and other contaminants. Unit comprises flat bed trailer with 500-gph reclaimer, 375 and 275-gal dirty and clean oil storage tanks, 50-kw gasoline engine generator, hose reels, and storage space for filter material. Central electric and valve control panels operate oil and vacuum pumps and provide ready readings of all pressures, temperatures, fluid levels, and direction of flow. Telescoping electric hoist handles two single cartridge, fullers earth filters.
Hilliard Corp, 100 W. Fourth St, Elmira, N. Y.



Wedge Grip Clamp . . .

. . . for triplex service can be installed with line gloves on. Design is such that all parts stay together while handling. Designated as No. 1060, it is made entirely of stainless steel and aluminum for strength and corrosion resistance. Clamp will not become deformed or distorted, even under maximum loading, and can be reused. It is intended for use at the pole and house end of a triplex service drop.
Porcelain Products, Inc, Carey, Ohio

Traversing Furnace Probe

. . . for boiler start-up measures temperatures in critical superheater or other furnace passes to guide operator in firing procedure. Probe consists of thermocouple mounted on the end of a lance which travels back and forth at speed of 6 fpm. Thermocouple can be used up to 2,200 F. For temperatures above 1,000 F, lance is air cooled at 250 cfm, 100 psi. Discharged air does not affect temperature reading. Temperatures registered by probe are within 10 deg of those from test thermocouple mounted in furnace pass. Lag between probe position and corresponding temperature is about one sec.
Copes-Vulcan Div, Blaw-Knox Co, Erie, Pa.

Recording Potentiometer . . .

. . . can be adapted to handle from two to 24 inputs by simple plug-in units. Changeover can be accomplished in three minutes, without soldering or refitting, by substituting different plug-in unit, dial indicator

and print wheel. The instrument can also be changed into pen-dragging type for single-point recording. Known as the Model 6702, it mounts in 19-in. relay rack and is available for wall or panel mounting. Other features include alarm switches, internal illumination, chart tear-off, low spare parts inventory, and accuracy of ¼%.
Weston Instruments Div, Daystrom, Inc, Newark 12, N.J.

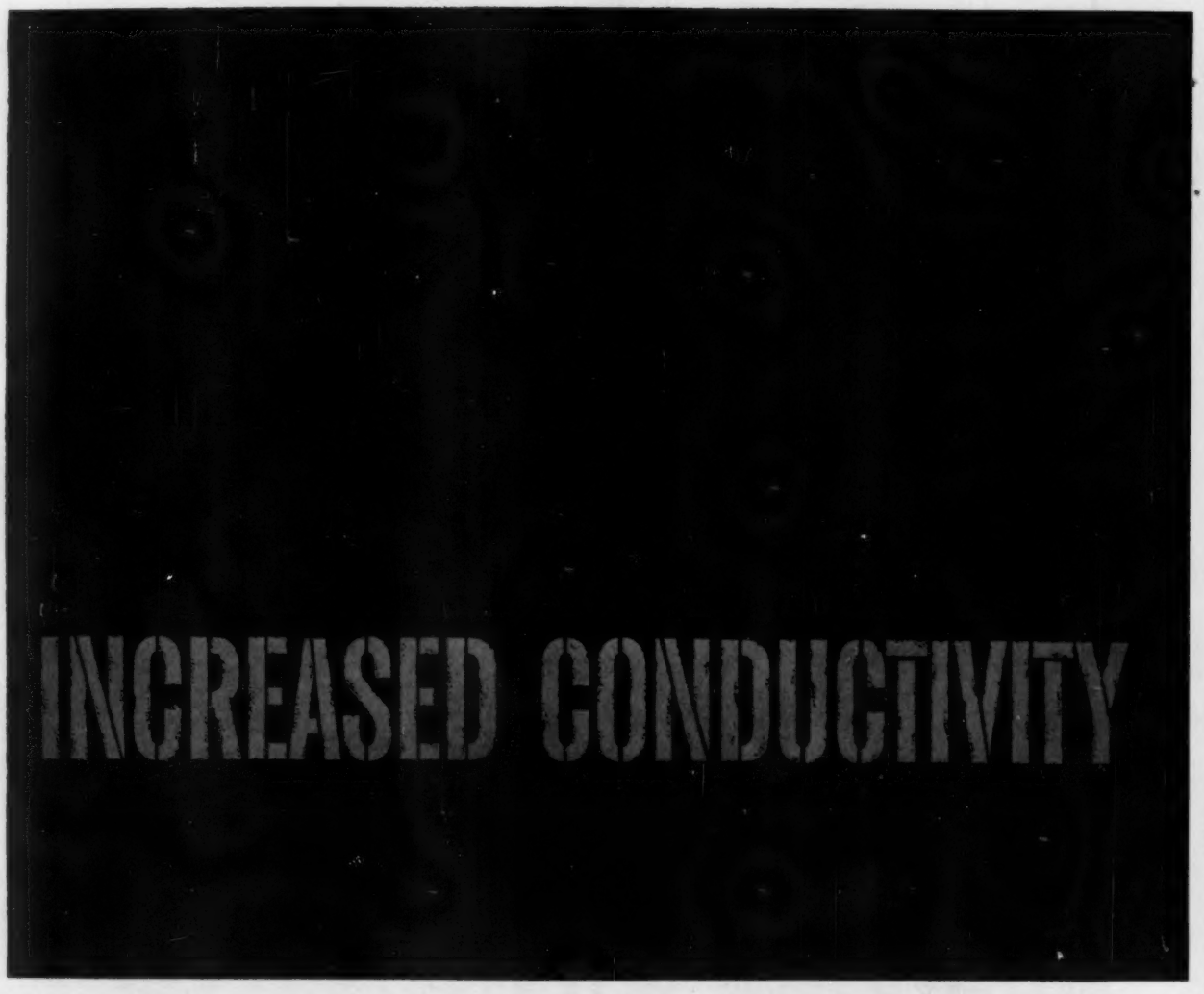
Distribution Transformer . . .

. . . has reduced copper loss and lower operating costs. Designated as the Super-Standard, this premium transformer is available in distribution sizes through 167 kva and 15/22 kv. Typical 50-kva, 2,400-v model has 30% lower copper loss. Coil design assures overload capacity at no extra cost. Terminals take either copper or aluminum conductors. Other features are shorter tank; less oil because of lower losses; lower noise level; improved thermal time constant; better regulation; and lower exciting current.
Standard Transformer Co, Warren, Ohio

Coated Dead Ends . . .

. . . for polyethylene and neoprene jacketed all-aluminum and ACSR conductors can be applied directly over jacket, without stripping. Full protection is provided because conductor is not exposed at any point. Application can be made by hand. There are no sharp edges to cut

(*Continued on page* 112)



SAVE $13.30 PER CONDUCTOR MILE PER YEAR WITH NEW

Here's How:

Conductor size: 795,000 cm ACSR 26/7
Weight per foot: 1.094 lbs
Peak load current: 500 amps
Demand charge: $200 per kw (average for company with both hydro and steam generation)
Annual cost of demand charge: 11%
Cost of energy losses: $0.0035 per kwh
Load factor: 50%
Loss constant: 2650 (Fig. 13-1, p. 1159, Standard Handbook for Electrical Engineers, 9th Ed.)

Operating temperature: 50° C
Interest rate: 4%
Amortization period: 30 years
Resistance per conductor mile, 61% conductivity: 0.1297 ohms
Resistance per conductor mile, 62.0% conductivity: 0.1280 ohms
Power loss per conductor mile for 61% conductivity:

$$P_L = I^2 r_a = 500^2 \text{ x } .1297 = 32.43 \text{ kw}$$

Annual cost of demand charge per conductor mile:

$$C_D = 32.43 \text{ x } \$200 \text{ x } .11 = \$713.46$$

Annual energy loss per conductor mile:

$$32.43 \text{ x } 2650 = 85{,}940 \text{ kwh}$$

Annual cost of energy losses per conductor mile:

$$C_e = 85{,}940 \text{ x } \$0.0035 = \$300.79$$

Total annual loss charges per conductor mile: $713.46 + 300.79 = $1,014.25

For 62.0% conductivity, annual loss charges per conductor mile are $1,000.95.
The annual saving between the two is $13.30 per conductor mile.
The present value of benefits is:

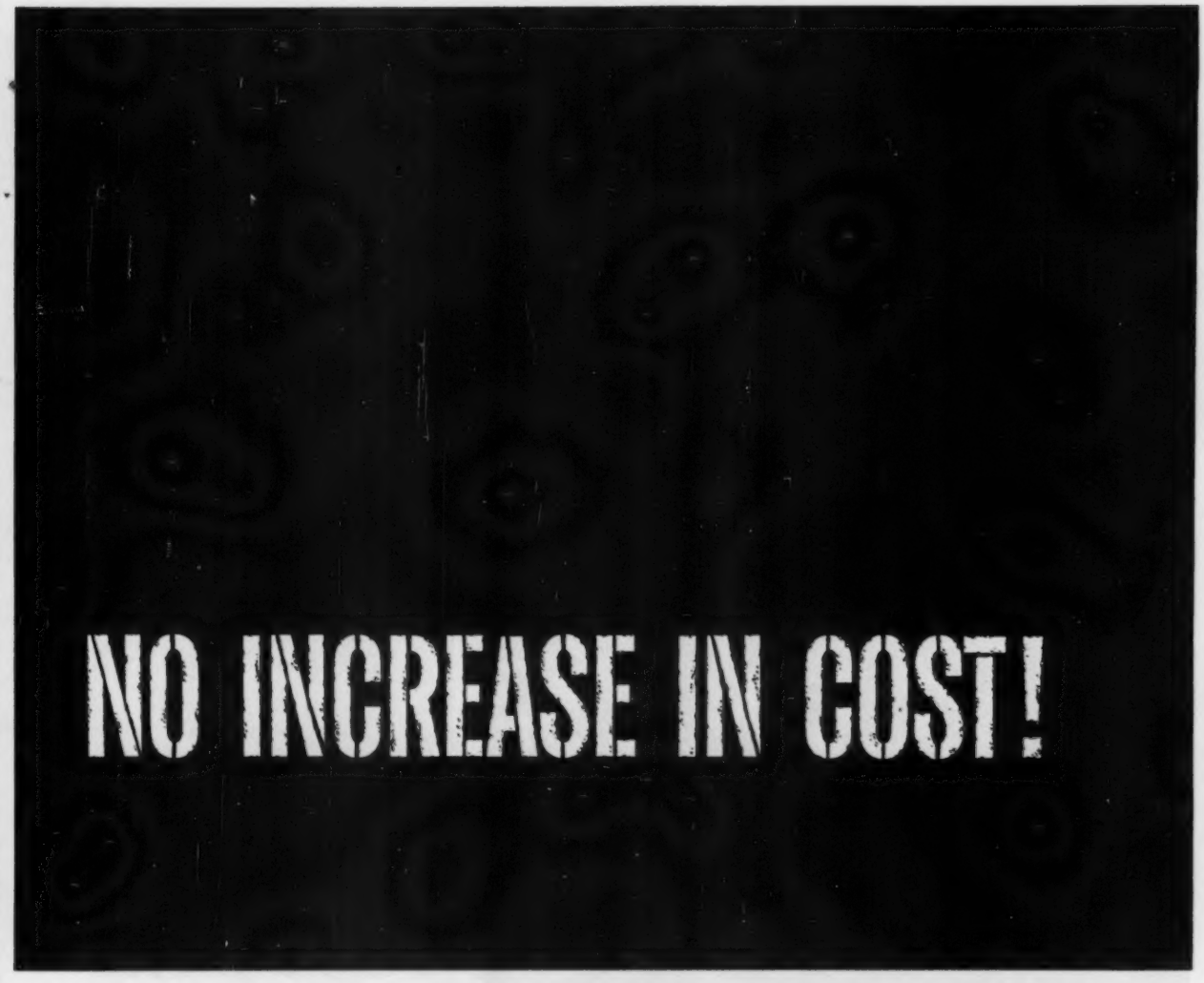
$$PV = C\frac{1-(1+r)^{-n}}{r}$$

$$= \$13.30 \text{ x } \frac{1-(1+.04)^{-30}}{.04} = \$229.96$$

Converted to per-pound value of conductor:

$$\frac{\$229.96}{5280 \text{ x } 1.094} = \$0.0398 \text{ per pound of conductor}$$

Note: This example is designed to show typical costs. Cost factors will, of course, vary for your area, resulting in smaller—or even greater—savings.



ALCOA MINIMUM 62.0% CONDUCTIVITY CONDUCTOR

Here's Why:

Alcoa's new electrical conductor standard with **minimum** guaranteed conductivity of 62.0% IACS (International Annealed Copper Standard) can save you money *right now.*

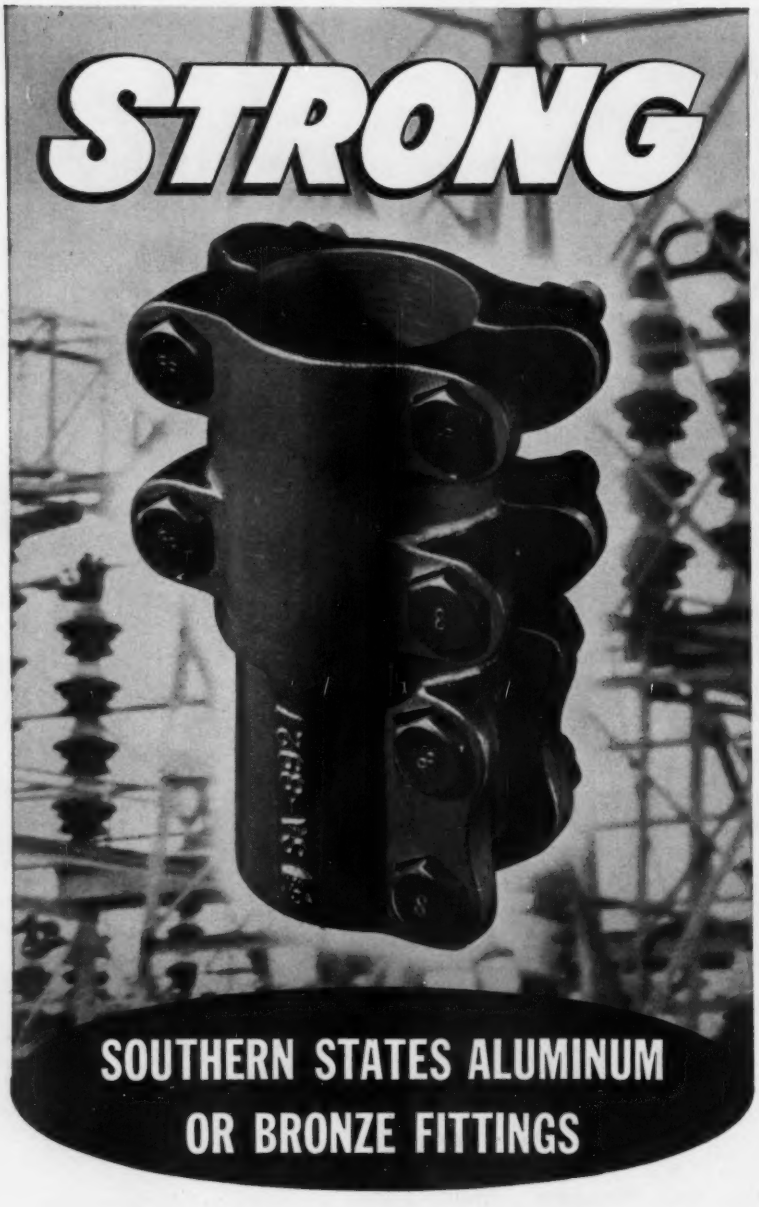
This remarkable new Alcoa development in electrical technology gives you an increase in conductivity at no increase in cost over EC grades of conductor formerly supplied. Extensive shipments have already demonstrated the complete dependability of this new Alcoa high conductivity guarantee. If you *must* consider other sources for *either* transmission or distribution, ask for certified test reports.

This new conductor is the latest example of Alcoa's leadership in research and development which for over half a century has produced increasingly efficient conductors and accessories for the nation's electric utilities. For more information on how Alcoa 62.0% conductivity conductor can result in savings on *your* system, call Alcoa. Aluminum Company of America, 2306-H Alcoa Building, Pittsburgh 19, Pennsylvania.

ALCOA ALUMINUM
ELECTRICAL CONDUCTORS AND ACCESSORIES
ALUMINUM COMPANY OF AMERICA

Your Guide to the Best in Aluminum Value

"ALCOA THEATRE"
EXCITING ADVENTURE
ALTERNATE MONDAY EVENINGS



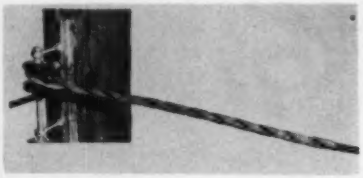
Frequent use of connectors as supporting members requires that they be physically strong as well as electrically sound. To achieve this, and yet avoid excessive bulkiness and weight, Southern States uses proven alloys—developed over a period of more than 25 years. All of the fittings in the ever-expanding line of Southern States connectors are designed to assure you of maximum strength. *Never underestimate the importance of a good connection!*

SOUTHERN STATES
EQUIPMENT CORP.
HAMPTON, GEORGIA

IN CANADA: Dominion Cutout Co., Ltd., Toronto

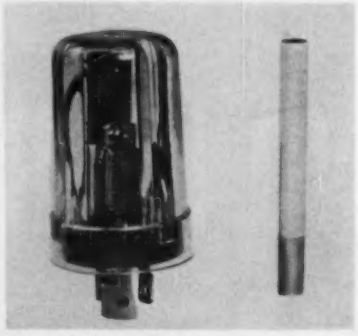
Coated Dead Ends

(*Continued from page* 109)



jacketing and no concentrated stress or fatigue points. Using a low unit pressure distributed over large area, these preformed units hold satisfactorily in all operating temperature ranges.

Preformed Line Products, 5349 St Clair Ave, Cleveland 3, Ohio



Streetlight Control . . .

. . . is small, easily installed, and requires little maintenance. Unit has only two components, a cadmium sulphide photo cell and a snap action integrating relay rated 15 amp continuous duty. Control measures 2.75 in. high by 1.75 in. across base. Housing is sturdy, transparent Tenite No. 2 plastic. It can be set to operate at light levels from one to six ft-c. Relay has 20 to 120-sec time delay to prevent false operation from momentary light sources.

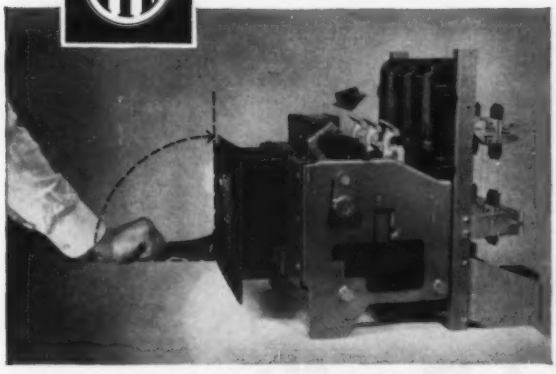
Precision Magnetic Controls, Inc, 34 Cottage Pl, Ridgewood, N. J.

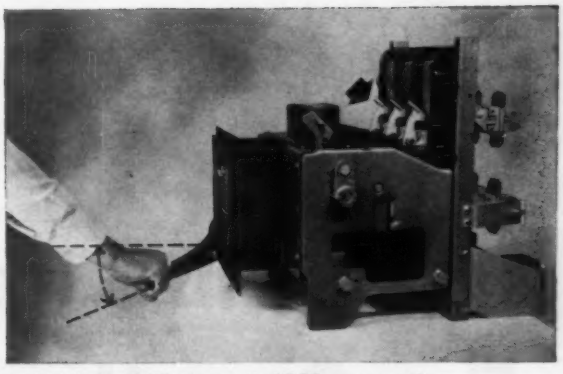
Al Alloy Dead Ends . . .

. . . cover clamping ranges from 0.356 to 1.630 in. in five sizes. Type AR1 is a single conductor strain clamp; Type AR2 (shown), a double. Compact design maximizes phase clearance. Aluminum

(*Continued on page* 116)

K-LINE LOW VOLTAGE SWITCHGEAR





Only I-T-E has manual quick-make operation available in 225 through 1600 amp rating

Only handle moves. Contacts are static during first 90% of pulldown handle travel. In this picture, arc chutes are removed.

Too fast for the eye. When stored energy mechanism passes crossover point, energy is released to close contacts within 5 cycles.

Only I-T-E has doors closed in all positions while racking

With breaker connected. Both power and control separable contacts are engaged.

In test position. Power contacts disconnected —control contacts connected.

Completely disconnected. Both power and control contacts fully disconnected.

Quick-make, manually charged closing feature and drawout with doors closed provide maximum safety for operator and circuit breaker

You can't tease and burn the contacts of the new quick-make K-Line of circuit breakers—the closing action is fast and positive. An ingenious stored energy mechanism does the job. It stores energy in the first 90% of the pulldown handle travel, releases it in the last 10%. Not until the crossover point is reached do the contacts move. And it closes in only 5 cycles—provides uniform closure every time. *More important, it is the only manually charged stored energy circuit breaker available that will close and latch against its short-time rating.* This means greater safety for the operator, less maintenance, and longer contact life.

You don't have to open the door to move the circuit breaker to test or disconnected position. The crank which operates the simple drawout mechanism fits into the escutcheon through a lift shutter. The shutter cannot be lifted while the breaker is closed. The breaker cannot be closed while the shutter is lifted. This means more than greater safety—you can forget the dirt problem; the nuisance of open doors impeding aisle travel; the risk of circuit breaker damage from exposure, even when completely out of service.

Bulletin 6004-C gives complete information about the new and safer I-T-E K-Line of low voltage switchgear. Contact your nearest I-T-E sales office for a copy. Or write Switchgear Division, I-T-E Circuit Breaker Company, 19th & Hamilton Sts., Philadelphia 30, Pa. In Canada: Eastern Power Devices Ltd., Port Credit, Ont.

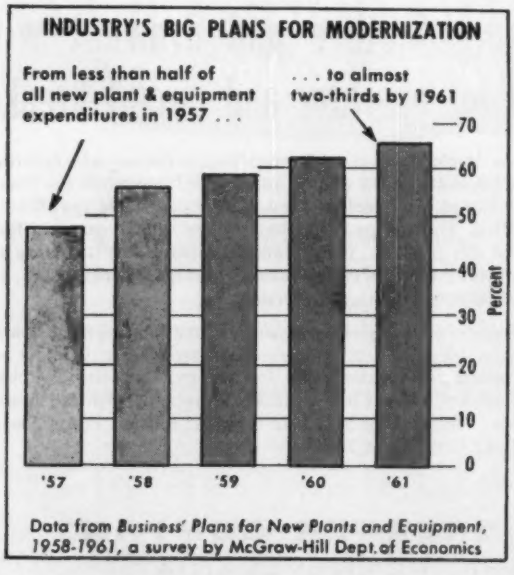
I-T-E CIRCUIT BREAKER COMPANY
PHILADELPHIA, PENNSYLVANIA

PLAN '59

A MESSAGE TO AMERICAN INDUSTRY

Modernize Now — For Growth and Profits

The biggest challenge facing American industry today is that of thoroughly modernizing its plant and equipment. This is the test period for companies to prepare for success — or failure — in the '60s. Success depends decisively on one key policy — modernization, for growth and profits.



Data from *Business' Plans for New Plants and Equipment, 1958-1961*, a survey by McGraw-Hill Dept. of Economics

The problem of business recession is fading. Sales and industrial production are moving up again, slowly. Business is swinging back into its normal course. This is growth, not retreat and recession. If the recovery takes us back to the normal growth trend, industrial production will be up 15% to 20% by 1960.

But how can we get this growth in production without the plague of price inflation that has blighted our economy in recent years? And, of fateful consequence for the individual business firm, how can it keep its costs down enough to make a decent profit — something a very large share of American companies are not doing today?

This is the new challenge that confronts business as the recession is left behind.

Nature of the Challenge

The recent record on costs and productivity is not reassuring. Since 1947 wages in manufacturing have risen 68%, while output per manhour has gone up 32%. This is a dismal record for a nation that has prided itself on

gains in industrial efficiency. Clearly, if we are to avoid continuing inflation, labor must key its wage demands more closely to productivity increases. But clearly, also, we must do far better in raising output per manhour. Otherwise, industry cannot hope to offer stable prices, and still make a profit.

What, then, is the answer? It is modernization of plant and equipment, the replacement of obsolete producing facilities with new and more efficient machinery and buildings. Only in this way can industry hope to increase production, hold down costs and make a good profit showing in the years of growth that lie ahead.

Industry's Answer

The chart on the preceding page shows how American industry is buckling down to the task of modernizing its facilities over the next four years. It is planning to replace old equipment with new machines that will raise output per worker not just 2% or 3% a year, but more like the 5% annual gain in productivity that this nation achieved in the years following World War I.

Since World War II we have had to contend with shortages of capacity and materials that have held back the job of raising productivity. But today the machines and techniques are available. And industry is getting set.

A broad sample of manufacturing companies surveyed by the McGraw-Hill Department of Economics earlier this year reported these plans: **In 1958, expenditures for modernization will rise to 56% of total investment in new facilities — compared to 48% in 1957. And this emphasis will increase until by 1961, expenditures for replacement and modernization account for two-thirds of all capital spending by manufacturing companies.** In dollar terms, manufacturers will spend more on modernization in each of the four years 1958-61 than in any previous year except 1957.

Can It Be Done?

These are big plans. Can they be carried out? Is it too visionary to hope that after a decade of expansion, industry can now find the outlets for huge amounts of capital investment in the area of modernization? The answers are important to business and the nation, because on this new wave of modernization depends our hope of holding down costs and prices, and also the prosperity of the vital capital goods industries — generators of boom and bust in our economy.

To ensure that industry gets the answers, McGraw-Hill's 34 business publications are now starting a coordinated effort — the largest editorial effort in the history of our company — to find, report and publish the opportunities for modernization at a profit, in the fields we serve. These special reports will begin in late September and will run through November, with appropriate coverage for the specific needs of each field. We are proud to share with industry the responsibility for making sure that no opportunity is overlooked in the drive to modernize now for growth and profits.

This message was prepared by the McGraw-Hill Department of Economics as the first step in our company-wide effort to report on opportunities for modernization in industry. The Department is also preparing a longer report, on modernization as a national problem, for publication in October.

Permission is freely extended to newspapers, groups or individuals to quote or reprint all parts of the present text.

Donald C McGraw

PRESIDENT

McGRAW-HILL PUBLISHING COMPANY, INC.

The Old Reliable

EVERSTICK ANCHORS...

EXTRA Holding Power
QUICKLY Installed
TOUGH For long life

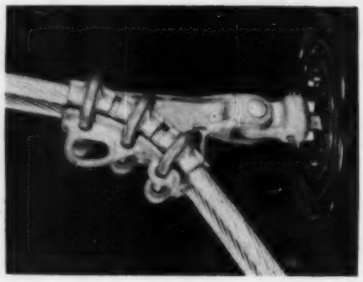
● They speed up work and provide dependable anchorage in new construction and maintenance. Quick and easy to install—made of tough rust-resistant malleable iron—their holding power "tops" all other. Available two-way, three-way, four-way, and cone types. Write for facts.

Exclusive Everstick nut housing Locks anchor firmly on rod. No chance of rod slipping thru anchor.

EVERSTICK ANCHOR CO
FAIRFIELD, IOWA

Al Alloy Dead Ends

(*Continued from page* 112)



U-bolts are permanently peened to the keeper. Cotter bolts are galvanized steel; speed cotter keys are stainless steel. Designed primarily for dead ending aluminum cable bus or ACSR bus, they are easily installed.
Anderson Electric Corp, Birmingham 1, Ala.

Thermal Insulation . . .

. . . composed of 99% fused silica will not oxidize or absorb moisture. Known as Foamsil, it is a rigid, lightweight, inorganic block with closed cellular structure. Available in 3-in. thick blocks of 11x17 or 17x22 in., it can be easily cut and shaped. It can be used as load-bearing surface and has expansion coefficient on only 0.00000035 per degree F. Density is 10 to 12 lb per cu ft. Specific heat ranges from 0.18 at 100 F to 0.277 at 1,200 F. Dielectric constant relative to air is 1.35. It resists all acids except hydrofluoric and hot phosphoric but must be protected against caustics and abrasion.
Pittsburgh Corning Corp, One Gateway Center, Pittsburgh 22, Pa.

Transmitter Booster . . .

. . . increases output of existing two-way radios to 250 or 330 w. Compatible with any existing a-c FM communications system, it consists of 250/330-w power amplifier and 250/330-w power supply, packaged in compact, office style cabinet. For existing systems providing 10-w excitation in 25- to 54-Mc or 144- to 174-Mc range, this Power-Mate unit produces outputs of up to 330-w output. For systems providing 15-w input at UHF, output is upgraded to 250 w.
General Electric Co, Communications Products Dept, Syracuse, N. Y.

Conductor Identifier . . .

. . . permits rapid identification and separation of up to four unidentified conductors simultaneously. Code signalling transmitter is attached to one end of conductors and common lead attached to ground. Transmitter sends out repetitive coded signals on each conductor. Code receiving device is attached to opposite end of conductors to identify each of the four. Weight of unit, including case and 20-ft cables, is 15 lb.
J. W. Dice Co, Englewood, N. J.

Correction

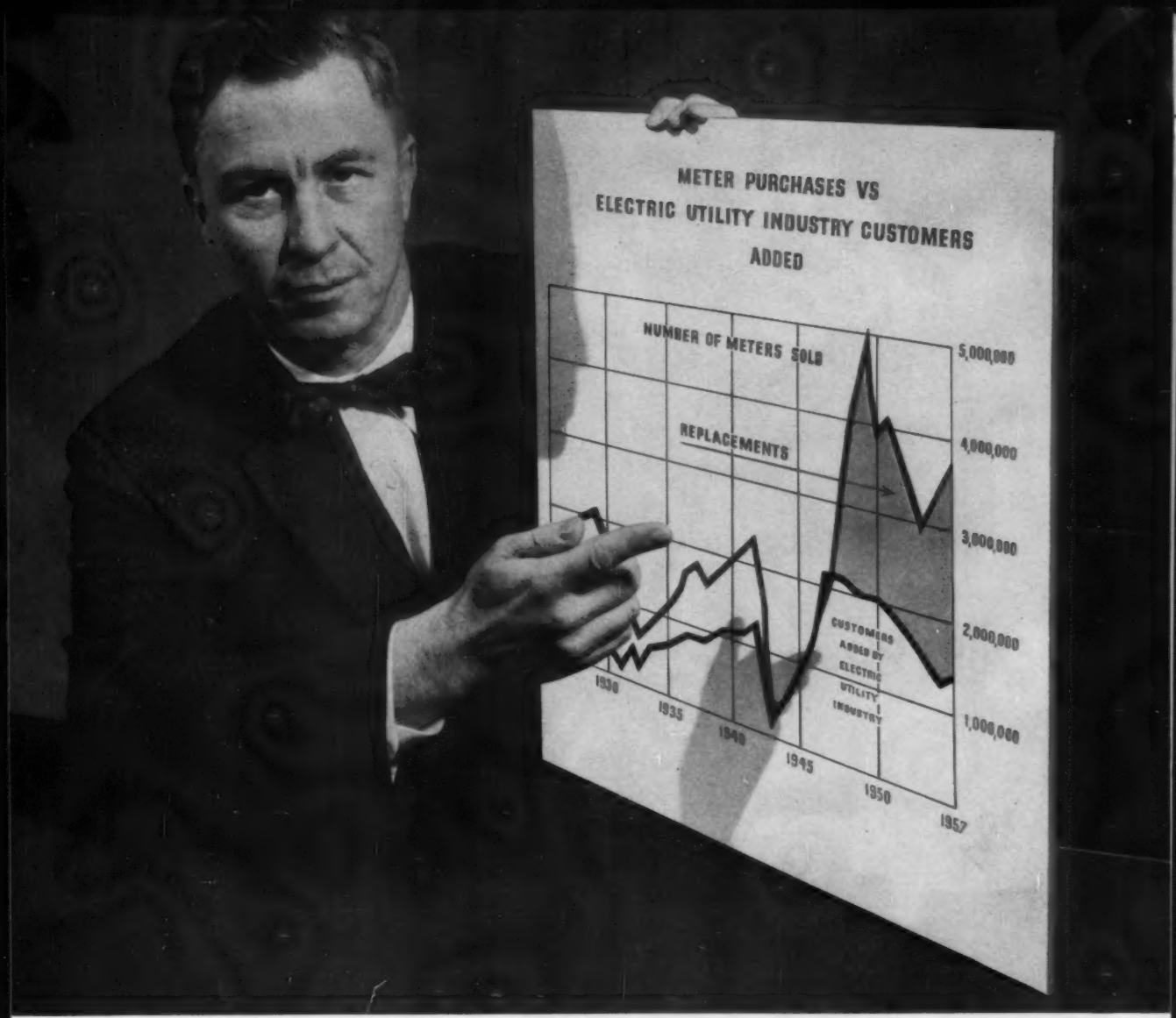
Cable Puller . . .

. . . for light distribution circuits is capable of handling reels up to 34 in. in width, 48 in. in diameter, and 5,000 lb in weight. In the May 12, 1958 issue of Electrical World, this Pengo 5400 cable puller, manufactured by the Petersen Engineering Co, Inc, Santa Clara, Cal., was erroneously described as weighing 5,000 lb.

More New Products

Synchronous motor-driven **timer** is available in one-min unit with one sec increment; three-min unit, three sec increment; five-min unit, five sec. increment. Operates on 110 v, 60 cycles. Publication EN-33.—Cutler-Hammer Inc, 235 N 12th St, Milwaukee 1, Wis.

Type EMT4104U **automatic voltage regulator** maintains a constant output voltage for loads up to 35 amp. With 108 to 137 v input, output is adjustable from 110-120 v, 35 amp, 4.2 kva; with 226-256-v input, output is 220-240 v, 35 amp, 8.4 kva.—Superior Electric Co, Dept EMT4104U, Bristol, Conn.



In the past ten years, 15 million meters have been needed to replace obsoleted units.

Will this costly replacement program hit you again in 1965?

J. A. Babcock, Manager
Watthour Meter Department
Westinghouse Electric Corporation

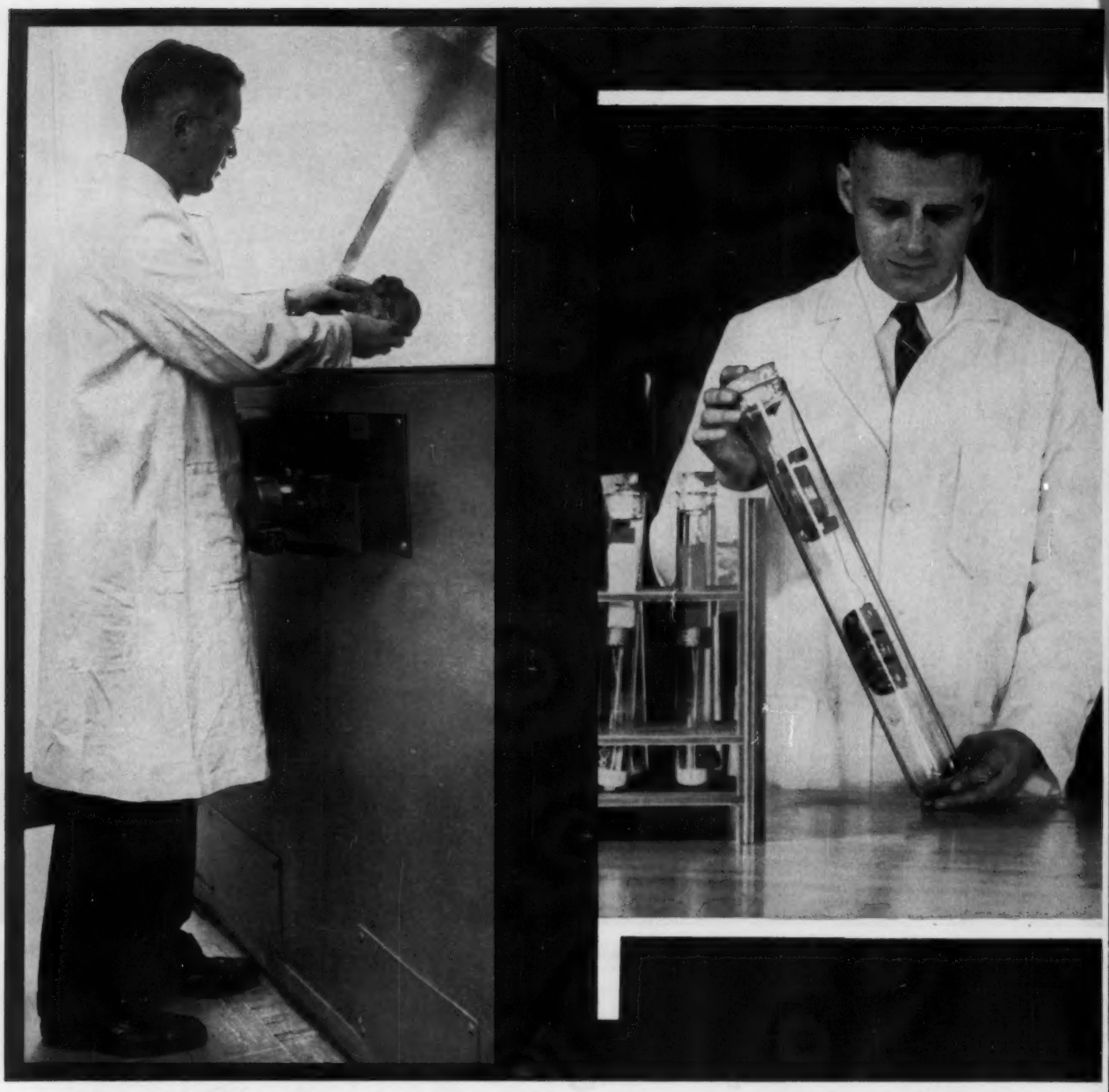
Obtaining Full Measure for your meter investment means meter capacity and durability for many years of dependable service.

The above chart indicates the number of meters the electric utility industry has been forced to purchase... over and above the new customers added. This expenditure reflects the replacement of many of the obsolete meters presently in service. Not that they are failing in any way to do the job for which they were built! The growing loads have simply found the old 5-and 10-ampere meters inadequate for this task.

The moral of the story is: Buy Class 200 meters with the capacity to meet your present and future loads... at the same price you've paid for conventional 15-ampere single-phase meters. It's another example of the Westinghouse philosophy of Plowback of Earnings for research.

Westinghouse has consistently pioneered significant contributions to the art of metering: the basic concept of the a-c meter, stroboscopic testing... among many others, the meter socket, first extended range meter, and automated load survey equipment. Buy Westinghouse meters to assure *continued Full Measure* in product superiority and forward-looking research. J-40508

Has your Westinghouse representative shown you how to get Full Measure for **your** meter dollar? Ask him for a copy of this informative presentation, B-7280.



At left, Tom Daley, supervising engineer, is inspecting a sample frame in a laboratory salt spray chamber where heat, humidity and salt fog give finishes a punishing test.

Frank Kuhn, engineering section manager, at right, checks an accelerated humidity test on the new single-metal-system register for corrosion...and investigates compatibility of parts.

From Plowback of Earnings

A Meter 2 to 5 Times More Corrosion Resistant

FULL MEASURE FROM WESTINGHOUSE METER RESEARCH

Development of new metal finishes and use of a single-metal-system register design have given Westinghouse single-phase meters from 2 to 5 times more corrosion resistance than conventional units.

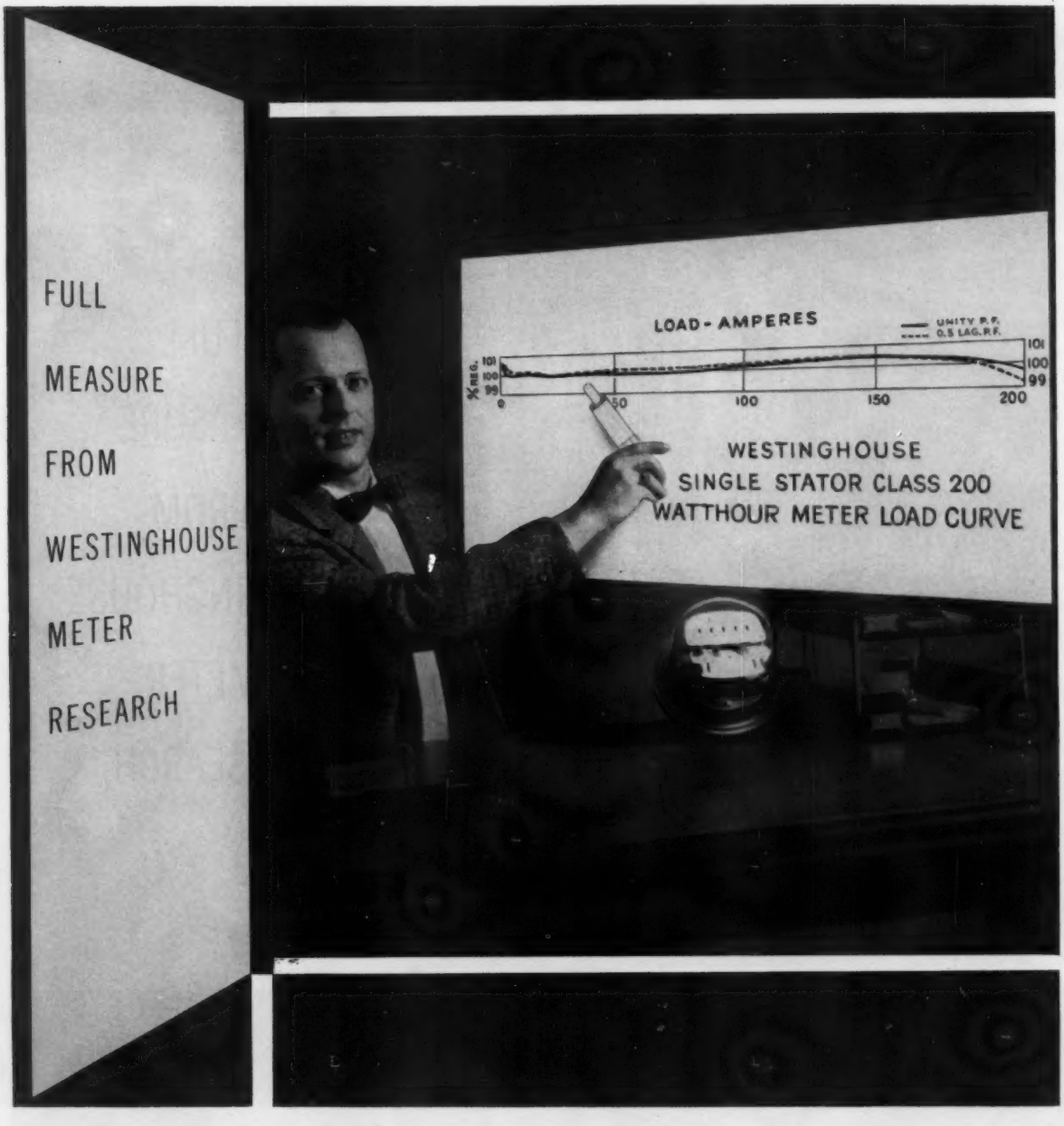
The elimination of dissimilar metals and use of a compatible finish system on all components in the register removes the possibility of electrochemical corrosion occurring under extreme environmental conditions.

Frame corrosion has been minimized by use of a new thermosetting epoxy ester enamel, which Westinghouse helped develop.

Not only were all the metals used in the meter tested *individually* for corrosion resistance, but any chemical interaction of components was thoroughly investigated. For instance, Westinghouse coil insulation, under heavy overload, *does not* produce fumes that will accelerate corrosion or condense on the working parts of the meter and glass cover.

To learn how you can reduce the cost of metering on your system, call your Westinghouse sales engineer. Or, write Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pa. J-40514

YOU CAN BE SURE...IF IT'S Westinghouse



Westinghouse class 200 lifetime meters insure... straight-line performance on all loads

Today's wide residential load range requires a meter that has both accuracy and ample capacity. The Westinghouse Class 200 Lifetime meter licks these two main problems — need for greater load capacity to meet present and future demands, and sensitivity to register accurately the many light loads which might escape notice on ordinary 30-ampere meters. In short, the Westinghouse Class 200 makes standardization on 30-ampere meters a paying proposition for utilities.

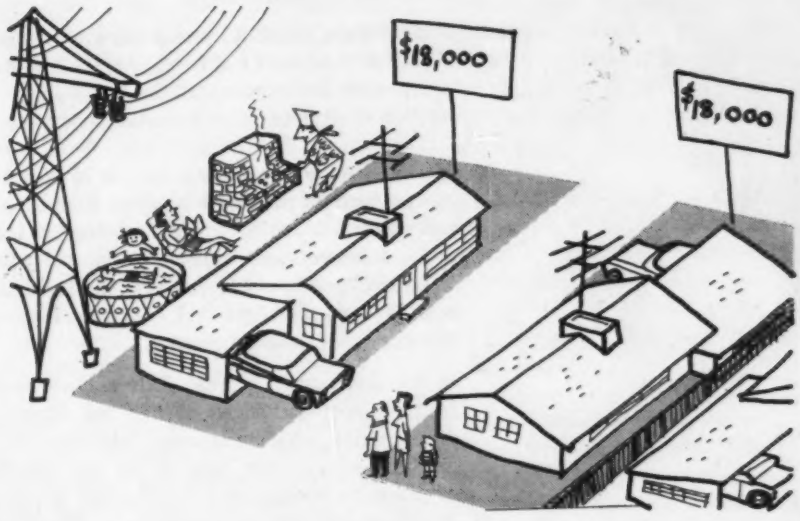
In the photo above, Fred Mindt, Engineering Section Manager at the Westinghouse Raleigh, North Carolina, Meter Plant, points out accuracy of registration of loads as low as ½ ampere or 120 watts — which is ¼ of 1% of maximum capacity.

For full information on Class 200 Lifetime meters, call your Westinghouse Representative, or write Westinghouse Electric Corporation, P.O. Box 868, 3 Gateway Center, Pittsburgh 30, Pennsylvania.

J-40505

YOU CAN BE SURE...IF IT'S Westinghouse

Report on
Right-of-Way



R/W's Don't Hurt Land Values

Utility rights-of-way rarely affect the value of adjacent property. Solid evidence in support of this conclusion has been building up for a long time. The most recent exhibit appears in the current issue of "The Appraisal Journal," a quarterly publication of the American Institute of Real Estate Appraisers, in an article by Cloice D. Carll. Based on more than 20 years' experience and over 1,500 interviews, Carll notes that some homeowners even prefer lots next to a utility easement, using the extra space for vegetable gardens, barbecues, and swimming pools; and concludes that "close proximity of the right-of-way did not adversely affect market value."

The sad truth, however, is that few people realize this. Most property owners, and all too many appraisers, lawyers, and realtors believe that the presence of a transmission line—with its angular steel towers and high voltage—will damage the value of real estate for some distance around.

This misconception costs the utilities heavily—both in good will and in dollars. Property owners must often be paid not only for the land purchased for the right-of-way, but also for some percentage of the value of adjacent land. And it's hard to put a dollar value on the poor community relations that sometimes follows a utility as it runs its lines through a section of town. Even though the property owners are liberally compensated, the town's residents often feel that the tower line is doing irreparable harm to the community—blighting its normal development by scaring away would-be buyers.

Some utilities have proved that this is not the case. By using factual land economics studies, at least a dozen utilities are making it easier to procure rights-of-way for their tower lines and substations. These studies help make negotiations smoother; they bolster community relations; and, if necessary, they provide strong evidence for submission in condemnation trials.

Orange & Rockland Utilities, Inc, whose area includes fast-growing suburbs, has made good use of these land-economics studies for six years. The com-

pany first had occasion to make such a study in 1952, when a citizens' group was trying to block a transmission right-of-way. The citizens contended that the line would cut land values in adjacent property and hamper further development of the community.

The company set out to prove that this was not necessarily so. Under the law, Orange & Rockland had to show that the right-of-way was necessary. In order to maintain its standing in the community, it felt it desirable to prove that erection of its lines along that route would not stunt the community's growth.

The company put together a booklet of facts and pictures that showed that there was no need for the right-of-way to hamper the orderly development of adjacent real estate. It included aerial photographs and maps showing that nowadays utility easements are surrounded by and often used for recreational purposes of all kinds. It showed that housing developments, custom-built homes, apartment houses, and light and heavy industry all were building right up to the boundaries of these easements.

In the same study, Orange & Rockland showed that houses built closer than 50 ft to another line which had run through the same community for many years carried a higher assessed value than did similar homes in the area under dispute—where there was as yet no transmission line. Here was concrete evidence to present to civic planners in refutation of the objectors' opinion. The company won permission to go ahead with its transmission line.

Recently, the utility took some more pictures of the disputed area. The pictures have been added to the study. They show that eight new houses have gone up since the transmission line was put in place, using all the ground on both sides of the right-of-way. A recent search of courthouse records indicated that the utility's easement had not had any adverse effect on the market value of the adjacent property.

The company estimates that this particular study cost about $1,200 to make. The study helped win its first case. In addition, it has been used effectively ever since to aid in negotiating for new rights-of-way. Says Vice President Francis Manley, the head of the land department: "That study has already paid for itself many times over."

Orange & Rockland provides another example of the value of gathering evidence to prove that transmission lines do not necessarily blight a community. Said Manley: "Some time ago we had occasion to meet resistance to our pur-

chase of an easement and erection of a high-tension line over a lake that was destined to become a municipal recreational area. We took a substantial number of ground and aerial pictures over other recreational areas in our own and adjacent company territories. These pictures demonstrated that it was a common occurrence for high-tension lines to be built over swimming pools, lakes, baseball and football fields, beaches, boat basins, and other types of recreational areas, almost without exception. They helped settle the matter to the apparent satisfaction of all parties, avoiding expensive litigation. Our line is now up, and the municipality has constructed a beautiful, active swimming pool on the property."

This utility is continuing to compile evidence that rights-of-way need not stand in the way of community development nor lower the value of surrounding real estate. As the occasion arises, they show this proof to community planning boards and other civic groups. The photographs show how nearby tracts have developed in spite of the utility's rights-of-way. The figures (which can be checked easily at the county courthouse) show that property values have not been damaged.

Houston Lighting & Power Co has conducted seven land economics studies since 1955. Right-of-way men from this company contact people who have bought property adjacent to rights-of-way and subdividers who have sold lots next to rights-of-way in the past. They take pictures and compile factual data on sale prices of property near the rights-of-way and of comparable property far from the rights-of-way. They obtain maps of comparable areas, showing how these areas developed after the line went through.

While prices vary, the company listed $300 as a typical expense for a study. The studies find constant use as a negotiating aid, Houston L & P reports, and have also been used in eminent domain proceedings. The utility is now making studies frequently. Here is their advice on how to go about making such a study:

"Obtain outside appraisals. Obtain as much information as possible on market value of comparable property. Contact real estate men and subdividers, and obtain concrete information on actual negotiations and sales. Take pictures and affadavits from property owners who are adjacent to right-of-way and have sold property adjacent to right-of-way."

Another utility made a search of prices in more than 300 sales of houses in developments affected by its transmission easements. Says the utility: "We found absolutely no difference in the selling price or mortgaging of any of the houses where they abutted our lines in comparison with houses away from the lines." The results of this study were used as a negotiating aid, and are now in evidence in a condemnation trial. More studies are planned.

This utility expressed the opinion that "if other utilities would make similar studies, and if all the information were pooled in one booklet, it would greatly help to remove the question of possible consequential damage when it is brought up by an owner both in negotiations and in condemnation hearings."

From Nothern Indiana Public Service Co comes this story: "One of the subdividers laid out a number of lots backing up to our right-of-way. He told us he anticipated these lots would be the last to sell; but, to his surprise, when he opened his subdivision for sale, all of the lots backing up to our right-of-way were sold in the same time that only four lots in the balance of the subdivision were sold. Here again, it appeared that the purchasers wanted additional space with no adjoining neighbors to the rear of their homes."

This experience was echoed by Pacific Gas & Electric Co. This company has found that "experienced developers of large tracts have no opposition to con-

structing houses contiguous to power line rights-of-way or substations," and that in fact these houses are often the first ones sold.

Los Angeles Dept of Water & Power made a study in 1952 of five subdivisions developed after construction of transmission lines on adjacent properties. The study was originally prepared for presentation before a public meeting of property owners who were objecting to construction of a 22-mile transmission line. The utility showed that average sale price of properties adjoining the right-of-way in these five subdivisions was $9,511. Average sale price of properties away from the right-of-way was only $9,372.

The cost of this study was about $2,500—the highest figure reported by any of the utilities that have made them. This cost included $1,500 for an independent appraiser and about another $1,000 for employees' time, supplies, photos, maps, and typing. The study has been used since 1952 for negotiations, public relations, evidence in condemnation proceedings, and as an aid in planning.

Another utility urges that these studies be made by independent experts "to avoid, as much as possible, the criticism that the study contains only data favorable to the company." This utility picked out a real estate broker who lived in the area to be studied and had sold a number of parcels next to transmission rights-of-way. When the right-of-way man from the utility approached him, the realtor's first comment was that he was sure that the transmission line right-of-way had affected adversely the value of property adjacent to it. However, when he had completed his study, his report was just as definite in pointing out that he could find no difference in sale value between properties adjacent to the line and properties located as far as a mile away.

The real estate manager says he plans to make full use of these studies in pending condemnation suits, but notes that they have been of little use in negotiations, "as the property owners simply will not accept the facts."

This utility still plans to make more studies, despite the skepticism of the property owners. The best endorsement of these land economics studies is the fact that the companies which have used them in the past are almost unanimous in their intention to compile more studies in the future. As the weight of their evidence accumulates, and as more utilities investigate and publicize the facts in their own service areas, it can be expected that the utilities will come closer to their goal of putting up transmission lines without tearing down community relations.

CHANCE BTH HIGH-CAPACITY DISCONNECTS

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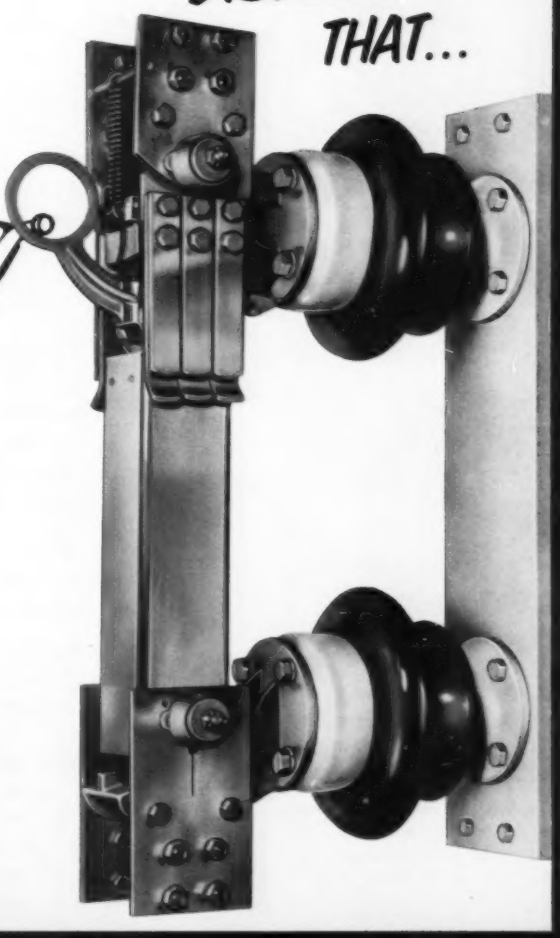
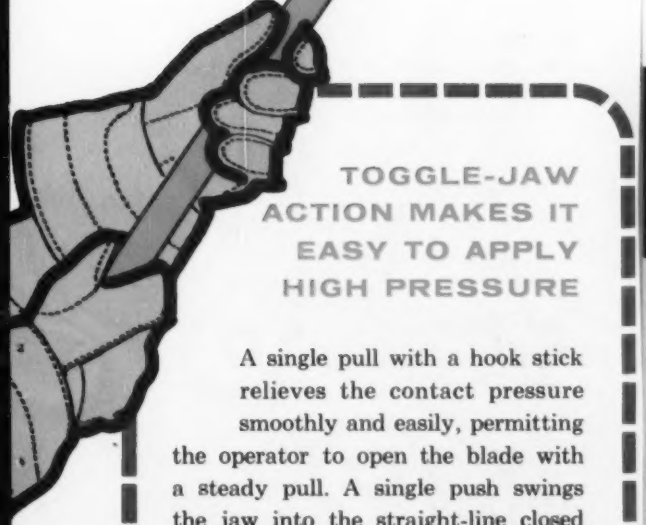
Here's an outstanding development in power switching equipment! The Chance Type BTH is a high-current disconnect that combines rugged construction with easy, positive operation. Now, the same operating and performance advantages of the 2000 Amp BTH are available in a 3000 Amp design.

The BTH meets all applicable AIEE and NEMA requirements. The 2000 Amp rating is available in voltage ratings from 7.5 to 46 KV; the 3000 Amp in ratings from 7.5 to 23 KV.

A NEW 3,000 AMP DISCONNECT THAT...



...OPENS WITH A SINGLE PULL!



TOGGLE-JAW ACTION MAKES IT EASY TO APPLY HIGH PRESSURE

A single pull with a hook stick relieves the contact pressure smoothly and easily, permitting the operator to open the blade with a steady pull. A single push swings the jaw into the straight-line closed position, gradually applying higher pressure to the blade as it closes.

This heavy duty disconnect gives new ease of operation in switching high-current circuits. High contact pressure is applied and relieved by the toggle-action of the jaw—minimizing operating effort.

This toggle-jaw action, plus the single blade operation, gives the operator positive control of the switch. In isolating, *one* pull disconnects the line completely—*one* closing and the switch is in *full* operating capacity.

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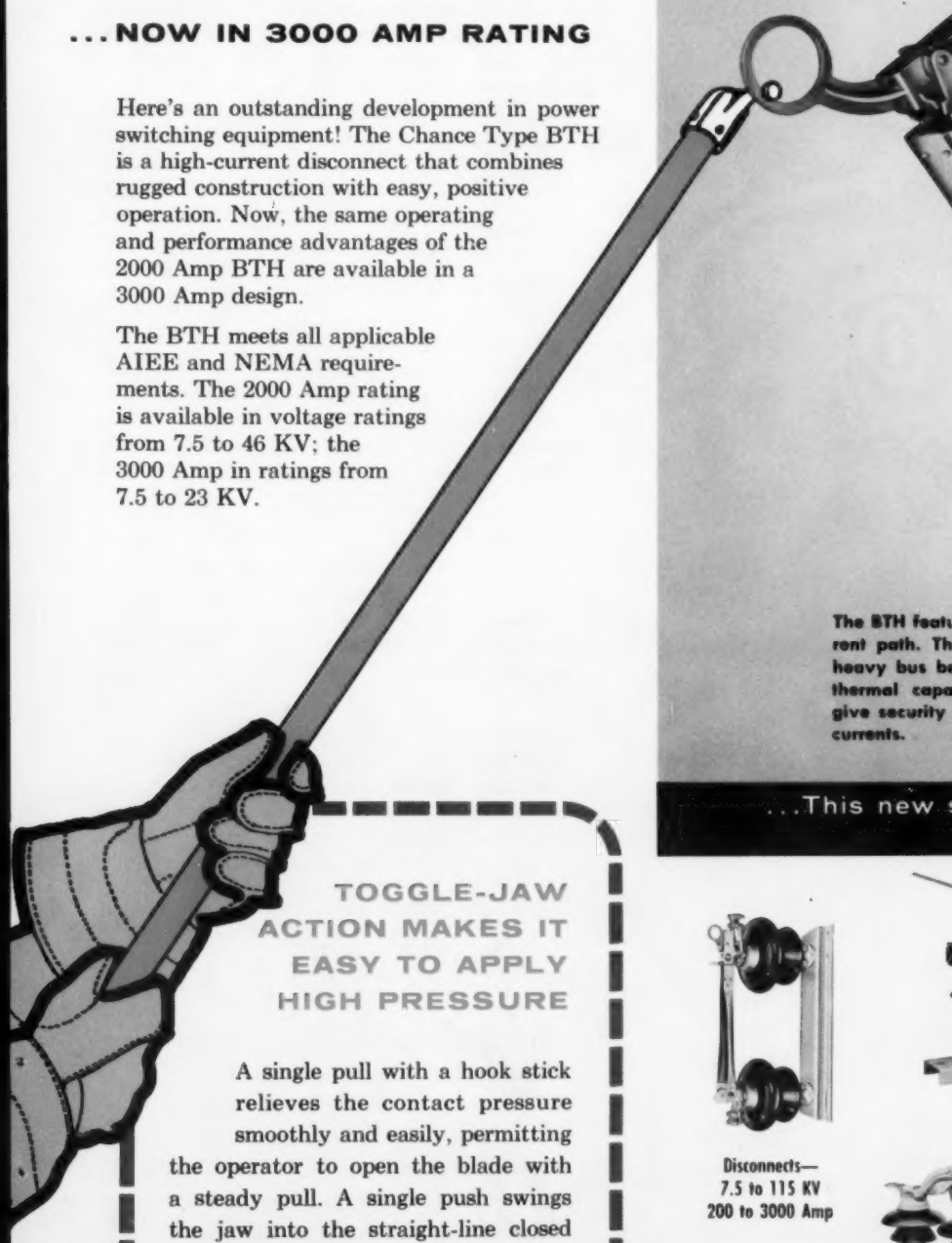


The BTH featu
rent path. Th
heavy bus b
thermal capa
give security
currents.

...This new

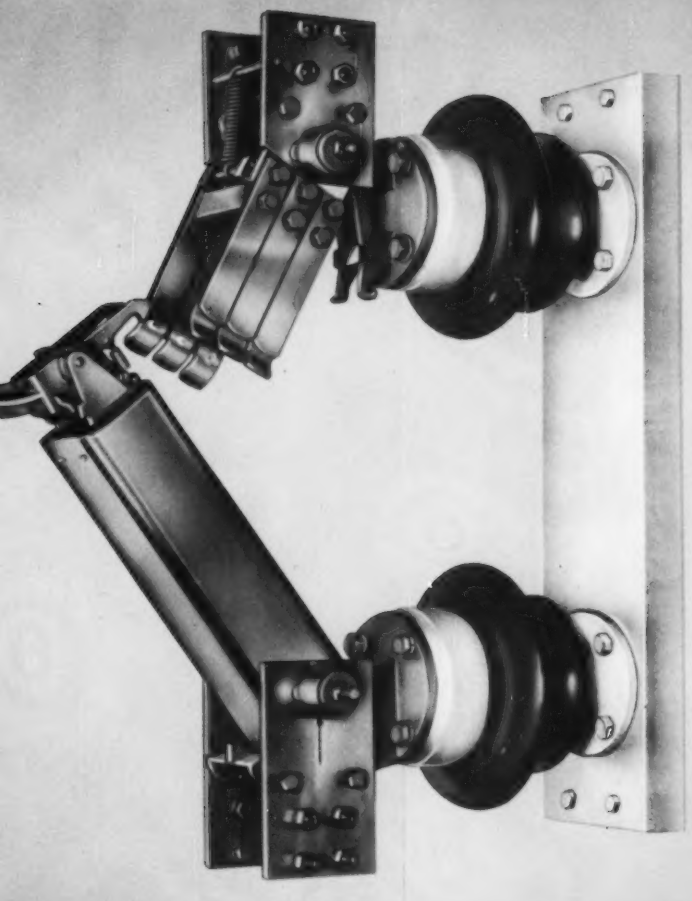
TOGGLE-JAW ACTION MAKES IT EASY TO APPLY HIGH PRESSURE

A single pull with a hook stick relieves the contact pressure smoothly and easily, permitting the operator to open the blade with a steady pull. A single push swings the jaw into the straight-line closed position, gradually applying higher pressure to the blade as it closes.

Disconnects—
7.5 to 115 KV
200 to 3000 Amp

Vertical Break—7.5 to 230 KV
400 to 2000 Amp

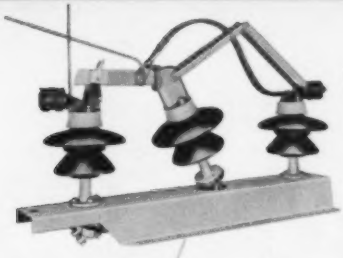
...you get
for 200 Am



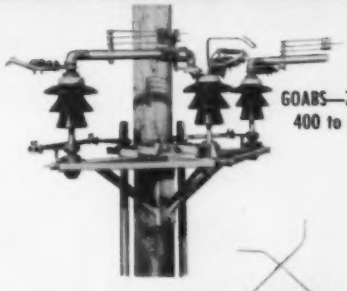
BTH features a simple, straight-through cur- path. The rigid square hollow blade and vy bus bar copper construction provide the mal capacity and mechanical strength to e security against damage from heavy fault ents.

BTH Switches have *high pressure* contacts—copper to silver buttons. Toggle action of jaw automatically applies high pressure with minimum operating effort. Double blade latch holds switch firmly in closed position, releases easily with a pull of the hook stick.

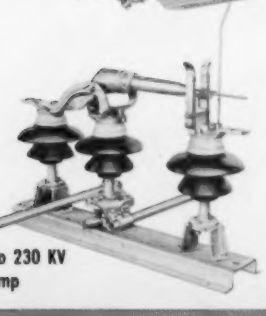
new switch is typical of the advanced switching equipment you get from the Chance line...



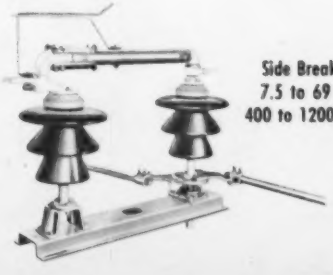
Tilting Insulator—
7.5 to 46 KV
200 to 600 Amp



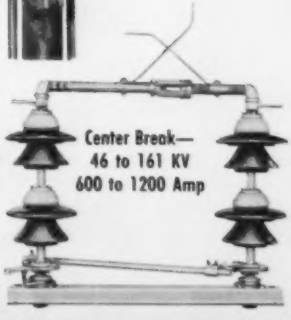
GOABS—7.5 to 69 KV
400 to 1200 Amp



o 230 KV
mp

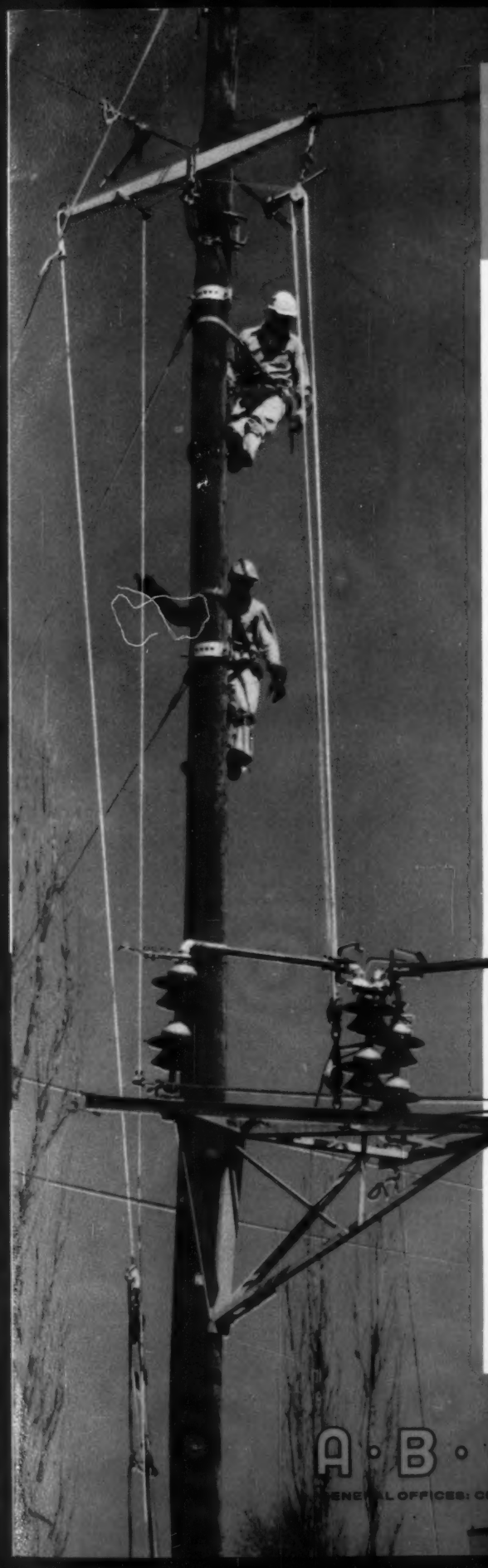


Side Break—
7.5 to 69 KV
400 to 1200 Amp



Center Break—
46 to 161 KV
600 to 1200 Amp

ou get the finest in engineering design wheather your requirements are 200 Amp disconnects or complete substation switching arrangements.



Cut tap switching costs by installing

CHANCE Type "GS" GOABS

You're dollars ahead from the start when you put Chance Type "GS" GOABS on the pole. GOABS are Group Operated Air Break Switches designed for vertical phase-above-phase mounting.

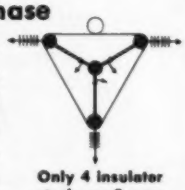
Only one pole for 1, 2 or 3 way switching

Single pole phase-above-phase mounting means lower initial costs, lower maintenance costs, and minimum right of way requirements.

Fewer Insulators per phase

Only 3 insulator stacks on 2-way

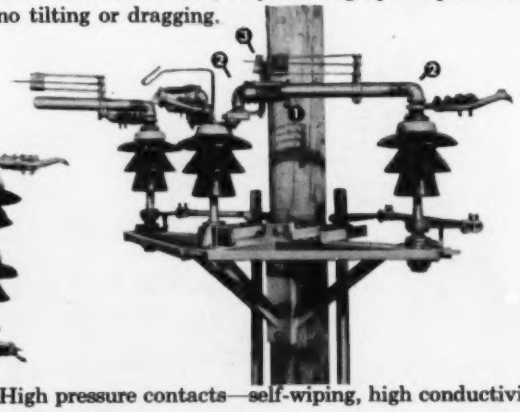
The "GS" design eliminates one insulator stack on each 2-way unit and two insulator stacks on each 3-way unit to provide up to 30% less weight.



Only 4 insulator stacks on 3-way

Speedy cost-cutting installation

GOABS are pre-assembled for maximum convenience in handling and installing. All-welded frames are completely assembled in all ratings. Assembling time is saved. Units are balanced for smooth, easy hoisting up the pole. There is no tilting or dragging.



1. High pressure contacts—self-wiping, high conductivity, silver to copper.

2. Braidless Construction—completely enclosed sealed silver-to-silver hinge contacts.

3. High-Speed Snap-Out Arcing Horns—to break magnetizing and charging currents.

Full NEMA *Rated*—7.5 to 69 KV, 400-600-1200 Amps, 1-Way, 2-Way and 3-Way.

C550-14

A·B·CHANCE CO·

GENERAL OFFICES: CENTRALIA, MO. (A.B. Chance Co. of Canada, Ltd., Toronto)

abc

This dimly lighted main street . . .

got a mercury-vapor facelighting, as . . .

Town Woos People, Business with Street Lights

H. J. RICHARDSON, Commercial Sales Representative, Pacific Gas & Electric Co, Chico, Calif.

The leading businessmen of the small northern California town of Orland were aware that something had to be done to attract more people and business to their community. New street lighting was one of the most needed improvements.

Orland approached Pacific Gas & Electric Co for help. As a result, we presented the city with a master street lighting plan to guide it in replacing its street lighting system.

After the plan was presented, the city began searching for funds to carry it out. Passage of a 1% city and country sales tax provided the necessary money to start the street lighting modernization program. PG&E was authorized to replace the old 52-unit, 6,000-lumen incandescent system with 38 15,000-lumen mercury vapor units on a new overhead 6.6-amp series system. (The old underground system was badly deteriorated and had many outages.) Ballasts are aerial-mounted on 30-ft steel poles fitted with 6-ft overhanging brackets.

Results of the modernization: a 750% jump in efficiency with only a 250% increase in operating costs. No records were kept of the maintenance costs on the old system; however, because PG&E is maintaining the new system entirely, a sizable maintenance savings will result. Group lamp replacement is expected to cut down outages.

Reaction to the new lights is good. Said Orland's Mayor Johansen: "The trend toward modern city lighting is one that cannot be ignored, even in a city as small as ours."

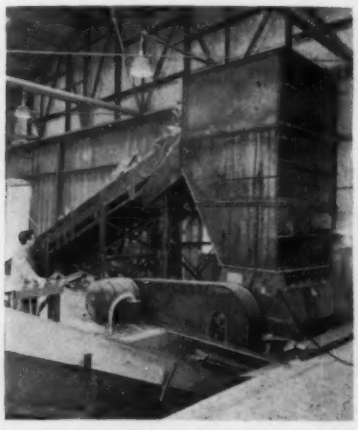
MP&L Wins Top Utility Division Award in NEMA Fan Contest

Minnesota Power & Light Co's R. E. Anderson walked off with first prize in the electric utility and department store division of this year's electric fan display contest, sponsored by National Electrical Manufacturers Association. The window display, for which MP&L won a $500 U.S. Savings Bond, is shown at left.

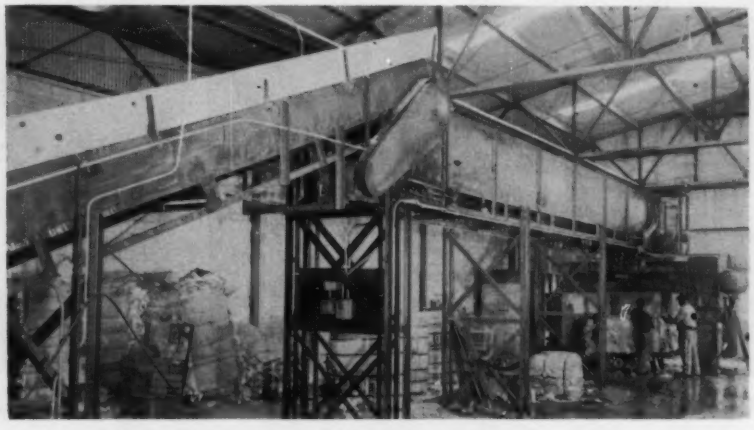
The NEMA contest is aimed at boosting fan sales in spring rather than in summer. It is built around window display on the premise that fans are primarily an "impulse" purchased item, and therefore, eye-catching point-of-purchase promotion is important.

Second prize in the utility division (a $250 bond) went to Public Service Electric & Gas Co. Other utility winners ($50 bonds each): Ohio Edison (two prizes), Philadelphia Electric Co, and New Orleans Public Service, Inc.

(*More Selling on p* 130)



From unloading dock to mill



. . . and on through baling operation . . .

Conveyors Spur Handling of Corrugated Waste

J. J. **DEUTSCH**, Industrial Sales Engineer, Baltimore Gas & Electric Co, Baltimore, Maryland

Electrified materials handling of waste has doubled the rate of production for corrugated scrap, reduced manhours, and lowered trucking costs 25% at Frank P. R. Bohager & Sons, Inc, waste paper processers in Baltimore. Four men now bale 50 tons daily compared to 25 tons by nine men previously. There are considerable savings on trucking costs because three trailers now haul the same tonnage as four under the old system.

With the new all-electric method, a belt conveyor on the receiving platform delivers the material to a 125-hp hammermill. The stock is chopped into the proper size for baling and processing at paper mills. The material then drops to a 3-hp moving belt which takes it to a ceiling-mounted 3-hp conveyor extending to the baler. When the baler is ready to receive a "charge" the conveyor gate is opened and the chopped cardboard falls into place. The gate is then closed and another load accumulated.

The 25-hp pneumatic baling unit can handle enough material to make a 1,350-lb bale. When the unit is filled the platen rises, compressing the waste to a thickness of 4 ft. Baling wire is applied, pressure released and the package is ejected automatically. Formerly, the heaviest bales weighed 1,000 lb, yet were the same size as the present heavier ones.

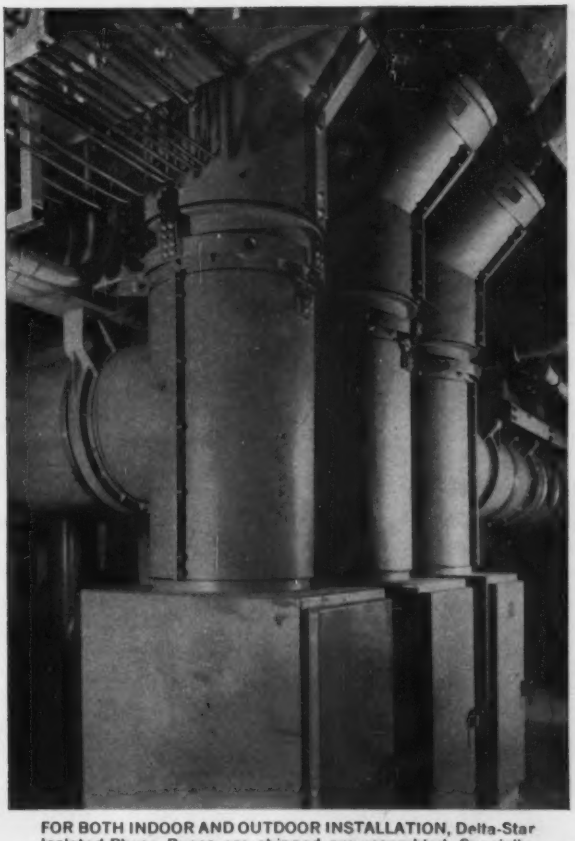
Under the previous method, a great amount of hand labor was expended in baling waste corrugated boxes. They were flattened by hand, carried to presses and manually loaded into place. Finished bales were carried to a scale for weighing.

Lighting Pays Off In Scrap Yard

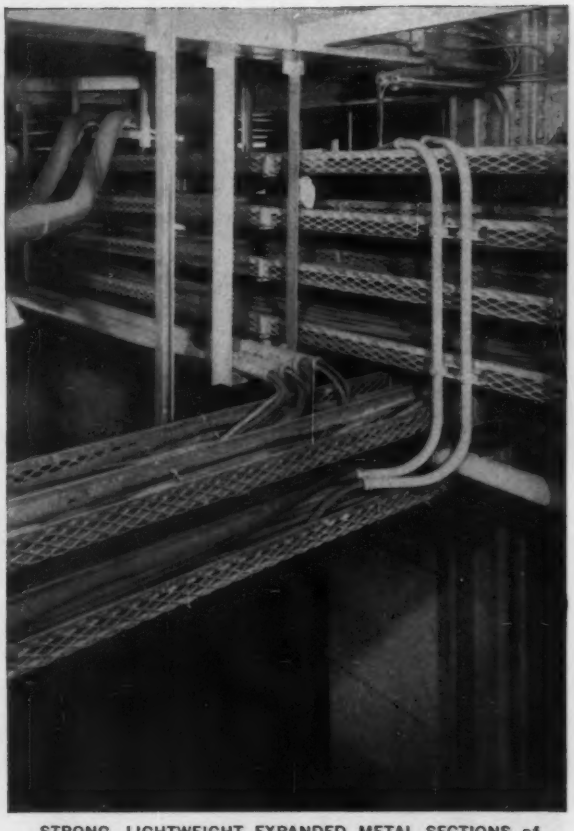
A new lighting system that produces up to 200 foot-candles is paying big dividends at the General Iron & Metal Co, a Chicago scrap yard. Employee efficiency and morale have improved. There are fewer customer complaints. And working conditions are better, too.

To determine the type and quality of the metal in the scrap, a close visual inspection is required. If these inspectors can not see properly and a shipment is consequently mislabelled, there is a good chance of losing a customer. Working on a narrow margin, the company depends on a quick turnover. Therefore, anything which increases employee efficiency pays off quickly. Mounted 13 ft above the floor, the fluorescent lamps provide 180 ft-c in most areas and 200 ft-c in

the most critical inspection areas. Formerly the most difficult identifications were done in daylight coming through an open door.



FOR BOTH INDOOR AND OUTDOOR INSTALLATION, Delta-Star Isolated-Phase Buses are shipped pre-assembled. Specially-shaped neoprene gaskets keep out dust and moisture, permit liberal misalignment of ducts without reducing seal. No longitudinal gasketing needed.



STRONG, LIGHTWEIGHT EXPANDED METAL SECTIONS of this Delta-Star Uni-Tray Cableway System provide adequate ventilation, prevent collection of water and dirt. Exclusive "Wedgit" fittings connect sections quickly without bolts, pins, or hinges.

SHIPPINGPORT CHOOSES DELTA-STAR BUS AND CABLEWAYS

SHIPPINGPORT, the world's first full-scale atomic power plant designed exclusively for civilian needs, is supplying 60,000 Kilowatts to the heavy industrial area around Pittsburgh, Pa.

Only components of known quality could be designed into the world's first full-scale atomic power plant devoted exclusively to peacetime needs. Duquesne Light Company engineers demanded and got the very best of materials for all generation and transmission equipment at the Shippingport plant.

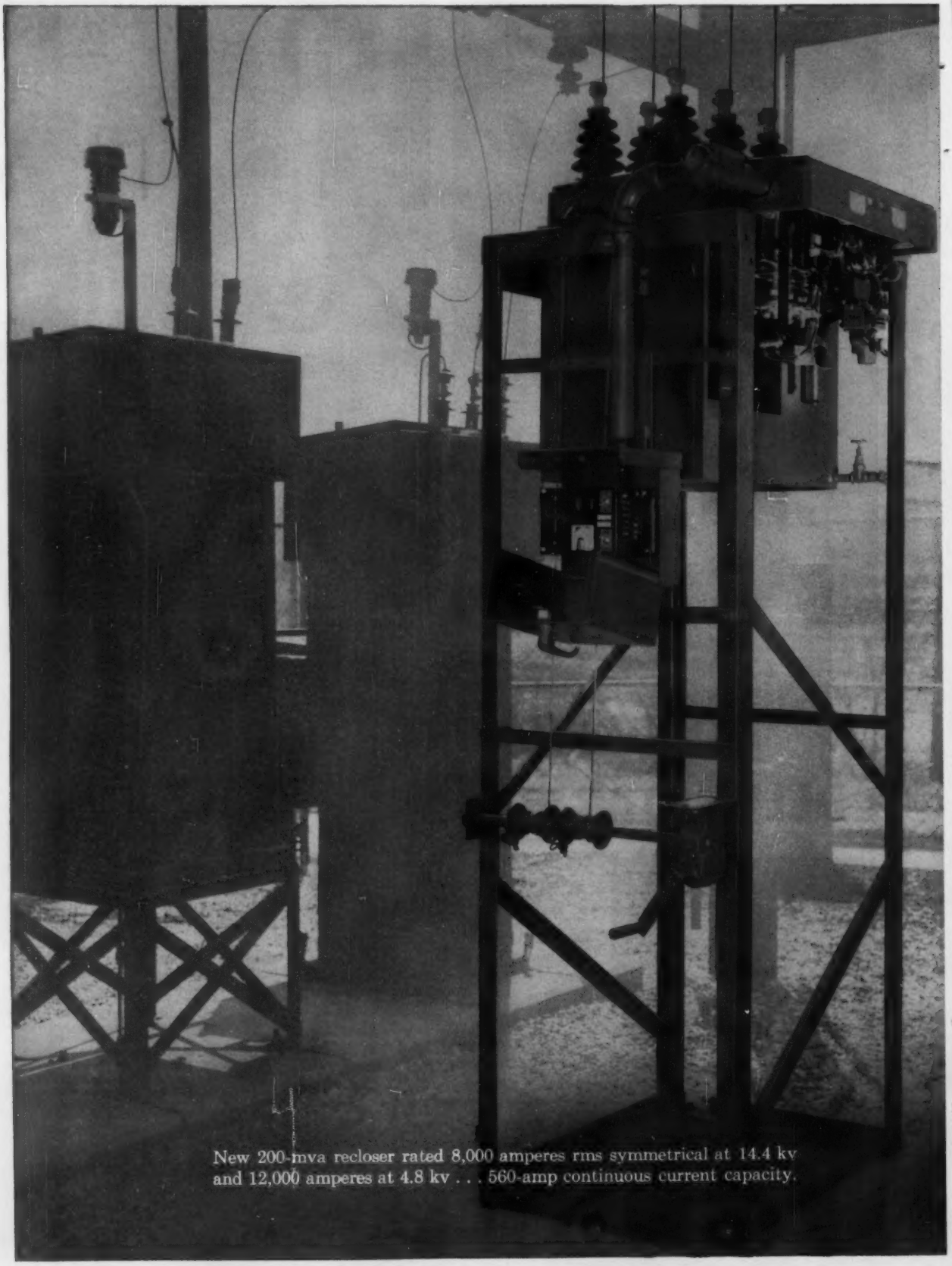
The choice of Delta-Star Isolated-Phase Buses and Uni-Tray Cableway Systems at Shippingport is proof of Duquesne Light's desire for top quality throughout the installation. Maintenance and inspection are made easy, installation is swift and economical with these two Delta-Star products.

COMPLETE INFORMATION about Delta-Star Isolated-Phase Buses and Uni-Tray Cableway Systems is available in these two illustrated catalogs. Ask your nearest Delta-Star representative for Bulletin 5006-B (Isolated-Phase Bus) or Publication 68 (Uni-Tray Cableways), or write Dept. 10C Delta-Star Electric Division, H. K. Porter Company, Inc., 2437 Fulton Street, Chicago 12, Illinois. District offices in principal cities.

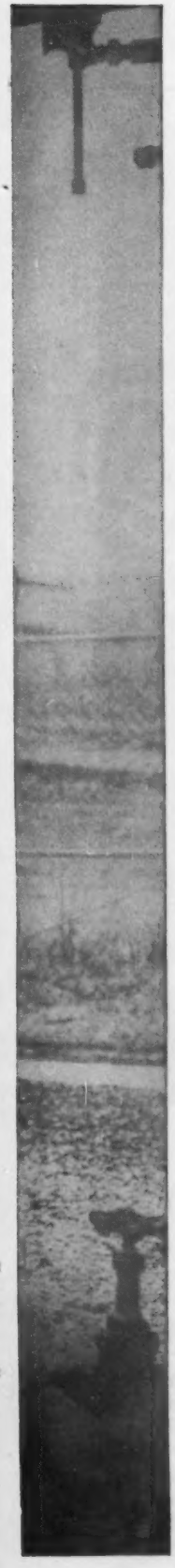
H. K. PORTER COMPANY, INC.

DELTA-STAR ELECTRIC DIVISION

Connors Steel, Delta-Star Electric, Disston, Forge & Fittings, Leschen Wire Rope, Quaker Rubber, Refractories, Riverside-Alloy Metal, Vulcan-Kidd Steel, H. K. Porter Company (Canada) Ltd.



New 200-mva recloser rated 8,000 amperes rms symmetrical at 14.4 kv and 12,000 amperes at 4.8 kv . . . 560-amp continuous current capacity.



Now... distribution circuit protection for 1/2 the cost of power circuit breakers!

Another product of Plowback of Earnings into Research

The new Westinghouse 200-mva three-phase power recloser brings you all the time-proven performance you've long associated with our line of oil circuit breakers, plus 2½- to 3-cycle interruption. Designed for economical distribution system protection, the new recloser is rated at 560 amperes continuous, and up to 12,000-amp maximum interrupting capacity.

Many of our oil circuit breaker assemblies have been incorporated in the new Westinghouse recloser. These rugged components, combined by design engineers who've pioneered circuit interruption techniques, provide the outstanding buy in distribution circuit protection available today.

In addition to the breaker bushings, grids and operating mechanism described below, the new 560 PR recloser utilizes proven air dashpots from the DB industrial breaker . . . providing flexible and reliable relaying characteristics which are unaffected by temperature. 600/5 breaker-type bushing CT's are used. Standard, adjustable SC ground relays give ground tripping sensitivity of 30 amperes.

Conservative design permits overload capacity under emergency conditions without damage to equipment. Combined with 2½- to 3-cycle interruption, this means maximum utilization of your system capacity . . . with minimum danger of conductor burndown or damage.

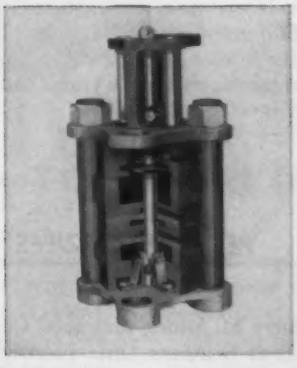
For complete information about the 560 PR recloser, call your Westinghouse sales engineer. Or, write Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pa. Ask for Descriptive Bulletin 38-725.

J-60054

YOU CAN BE SURE...IF IT'S Westinghouse

CONDENSER BUSHINGS

Standard Micarta® breaker condenser bushings are used for ruggedness to resist the high shocks of severe fault interruptions.



CIRCUIT BREAKER GRIDS

Unique high pressure current transfer roller of De-ion® grids provides high-speed 2½-cycle opening to prevent conductor damage and burndown.

NETWORK PROTECTOR MECHANISM

240-volt motor closing mechanism. This low-voltage control permits easy checking of your calibration curves and simplified maintenance. Mechanism provides 30-cycle high-speed reclosing.

West Penn Electric Elects Three Vp's

West Penn Electric Co has announced the election to vice president of Charles B. Finch, Hugh D. McDowell and E. Wallace Wilkinson

Finch was elevated to vp from his former position of assistant vice president. A graduate of Yale University and Yale Law School, he is a member of the New York Bar. He joined West Penn in 1954 as assistant vp following 10 years with a New York law firm.

McDowell has been with the Penn System for 35 years, the first two with West Penn Power Co, later with the parent organization in New York. He was elected assistant secretary in 1935 and secretary in 1941. He is an alumnus of Rensselaer Polytechnic Institute.

Wilkinson became a member of the company's tax department in 1943 after working for Chemical Corn Exchange Bank and Allied Chemical & Dye Corp. He became assistant treasurer in 1947 and treasurer in 1952. He is a graduate of Bucknell University and Fordham Law School.

In other promotions, Allen Kenyon was made comptroller, Francis J. McAlary was appointed an assistant vice president and Edward A. Gage was elevated to assistant treasurer and assistant secretary.

FINCH McDOWELL WILKINSON

Balentine Elected Edison Vp

William H. Balentine has been elected a vice president of Thomas A. Edison Industries, McGraw Edison Co. He had been manager of the Instrument Division since August 1957, and will continue in that capacity.

Balentine graduated in 1942 from the Newark College of Engineering, Newark, N. J., with a B.S. degree in electrical engineering.

He served with the Navy during WW II and also in the Korean conflict, rising to the rank of commander. Still active in the Navy, he is now an instructor at the Naval Reserve Officers' School in Elizabeth, N. J.

Balentine has been with the Edison organization for 17 years, and is a member of the Chamber of Commerce of several communities.

BALENTINE

PERSONAL BRIEFS

Vincent M. Cleaveland, manager of Clark County PUD, Vancouver, Wash, has been elected president of the Northwest Public Power Association, following the resignation of **P. C. Spowart.**

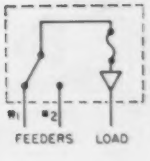
Central Illinois Light Co has appointed **Herbert A. Blair** comptroller, succeeding the late **A. W. Egger.**

Harry M. Miller, president, Columbus & Southern Ohio Electric Co, has been elected president of the Ohio Electric Utility Institute.

James M. Barry, chairman of the executive committee of the Southern Co, has retired after more than 30 years in the electric utility industry.

Henry M. Turrell has been made general sales manager of Kansas City Power & Light Co and transferred to the company's main office. In another promotion, **Glenn S. Young** has been appointed director of area development. **G. A. Jennings** becomes manager of power and lighting sales, and **John A.**

(*Continued on page* 136)



UNICLAD with feeder selector oil switch, 3 pole, 15 kv, 400 ampere full load break and three disconnect type power fuses.

G & W SWITCHGEAR—TO SUIT *YOUR* REQUIREMENTS

Profit by G&W's experience in designing and manufacturing countless combinations of switchgear to suit customers' specifications and budgets. A solution to your problem may exist in our files. Or a slight modification of a similar installation may save you hundreds of dollars in engineering time.

Typical of the G&W line of switchgear—rated from 5.0 to 34.5 kv, 75 to 200 kv BIL—is the Uniclad illustrated. It is a G&W "custom" job made to suit the plant layout and operational convenience of a large west coast laboratory. Four such units serve as primary service entrance switches to the plant. In each, standard components were used. A three position selector is used to transfer the feeder circuits manually (provision is made for adding an automatic control) in the G&W load break oil switch. Installation at the site is simplified by assembling all components at our factory in the trim looking Uniclad (metal enclosure).

Get switchgear to suit *your* requirements the quickest and easiest way—call a G&W representative.

G&W ELECTRIC SPECIALTY COMPANY
3500 W. 127TH STREET • BLUE ISLAND • ILLINOIS
CANADIAN MFR.-POWERLITE DEVICES, LTD.-TORONTO, MONTREAL & VANCOUVER
U582

Look to
Superior for

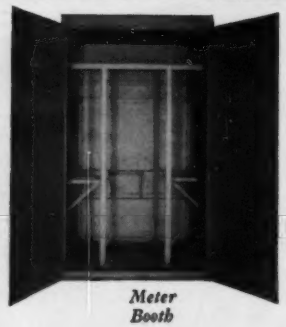
ENCLOSURES

Superior also
offers a complete line
of

TEST SWITCHES
TEST BLOCKS
SOCKET EQUIPMENT
TEST TABLES

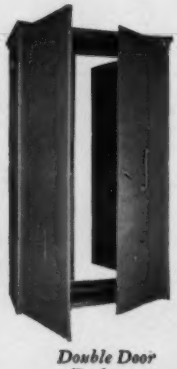
Catalog 55 offers complete information on features, services, types and sizes. Write to:

SUPERIOR
SWITCHBOARD & DEVICES CO.
CANTON, OHIO
A subsidiary of
The Union Metal Manufacturing Company



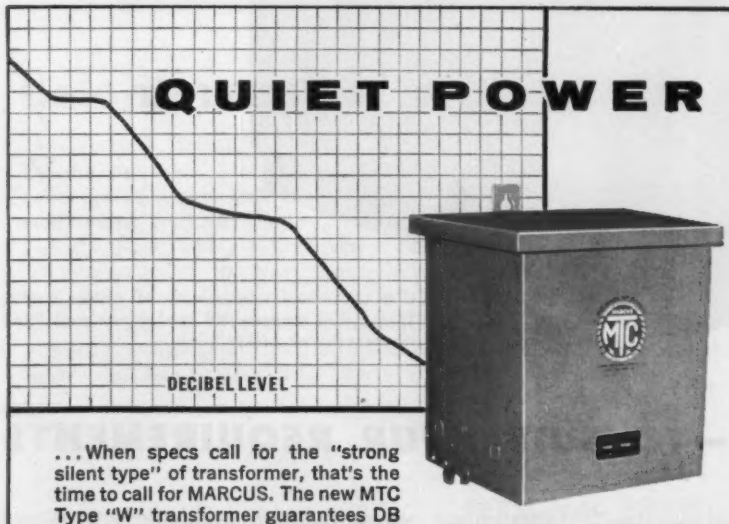
Meter Booth

Current Transformer Enclosure



Double Door Enclosure

QUIET POWER



...When specs call for the "strong silent type" of transformer, that's the time to call for MARCUS. The new MTC Type "W" transformer guarantees DB LEVELS THAT ARE BELOW NEMA STANDARDS. So for those extra quiet installations, Specify MARCUS---- Proven quieter by independent laboratory test.

- LOWER SOUND LEVELS
- LOWER WEIGHTS
- LOWER INSTALLATION COSTS

MARCUS TRANSFORMER CO., Inc.
RAHWAY, NEW JERSEY
"Mark of Quality"
Representatives in Principal Cities

A COMPLETE LINE OF DRY-TYPE AND LIQUID-FILLED TRANSFORMERS FROM 1 THROUGH 5000 KVA.

Kramer has been elevated to manager of the Kansas district.

Made fellows in AIEE recently, were the following individuals:

• **John H. Nehr,** research engineer, for "contributions to protective relay schemes and research on the thermal factors in underground power cables."

• **Elmer G. Norell,** Sargent & Lundy, for "his contributions to the advancement of large scale electrical power generations".

• **Percy H. Robinson,** Houston Lighting & Power Co, for "contributions to economical design and protection of an electric power system".

• **Richard F. Stevens,** Bonneville Power Administration, for "contributions to the development of major high voltage power systems in the Pacific Northwest".

• **Pierre J. Ailleret,** France, for "contributions to planning, execution and interconnection of a nationwide electric system".

• **Thomas Browne Jr,** Westinghouse Electric Corp, for "research contributions to rapid arc quenching for high voltage circuit interrupters".

• **Francois Michel Cahen,** France, for "contributions to stable, secured operation of an extra high voltage continental interconected system".

• **James Harlow,** Philadelphia Electric Co, for "notable contributions to improvement in economy of electric power generation".

• **Edgar Kanouse,** Los Angeles Department of Water & Power, for "contributions to the art of high voltage power transmission".

• **Harry Lott,** Southern California Edison Co, for "contributions to the planning and operation of a major power system and the operation of major power system interconnections".

• **Louis Meyerhoff,** General Cable Corp, for "contributions to the development of high voltage cables".

(*Continued on page* 138)

For Niagara Power, B-L-H builds America's mightiest turbines—200,000 hp Francis type

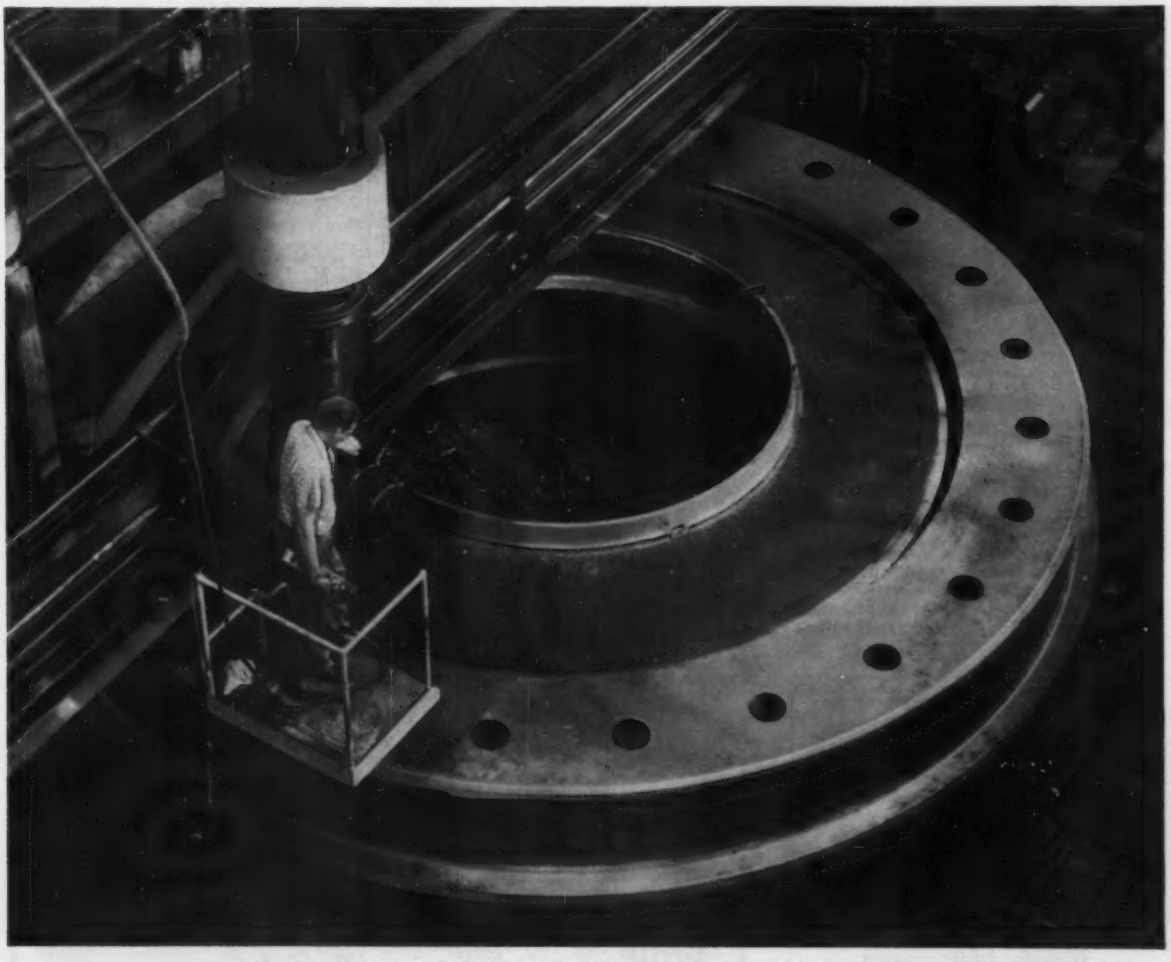
Work is now well underway at Baldwin-Lima-Hamilton's Eddystone Division on an order for seven Francis-type turbines—the most powerful hydraulic turbines ever made in the United States—for the main generating plant of the Niagara Power Project. Each is rated at 200,000 hp when operated for best efficiency at 120 rpm under 300-ft. head.

The first turbine is to be delivered by June 1, 1959. First power from the huge plant, a 2,000,000 kilowatt installation, is scheduled for 1961.

The Niagara Power Project is only one of many hydroelectric operations throughout the world—The Dalles Dam, Garrison Dam, St. Lawrence Power Project, to mention a few others—that have called upon B-L-H's 130 years' experience in designing and building hydraulic turbine equipment.

For specific information about our products and services, write to Eddystone Division (B-L-H), Philadelphia 42, Pa., or Pelton Division (B-L-H), 2929 Nineteenth St., San Francisco 10, Calif.

Artist's conception of Niagara Power Project's main generating plant. Courtesy Power Authority of the State of New York.



Head cover for one of Niagara turbines being machined on 25-ft. boring mill at B-L-H's Eddystone Division

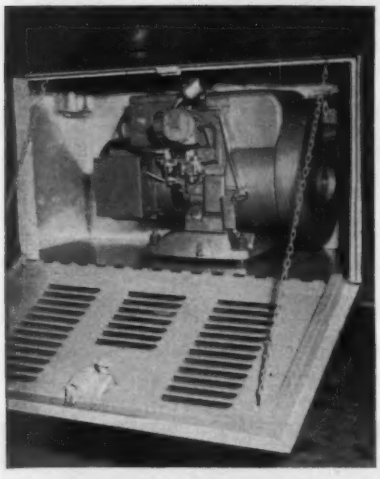
BALDWIN · LIMA · HAMILTON

Eddystone Division

Philadelphia 42, Pa.

Hydraulic turbines • Weldments • Dump cars • Nonferrous castings • Special machinery • Bending rolls • Machine tools

ELECTRIC PLANT NEWS



Charges truck batteries at far less cost... provides A.C. power, too!

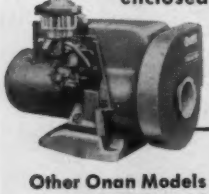
Before the dual-purpose Onan Electric Plant was installed on this maintenance truck, it was necessary to run the 160 H.P. truck engine to charge batteries for communications. Now, the 2 H.P. Onan Electric Plant does the same job . . . saving fuel and engine maintenance.

These battery charging-A.C. combination electric plants are available with 1,000 or 2,000 watts of A.C. output for operating tools and lights. Either size also delivers a full 30 amperes . . . enough to handle battery drain from radio and lighting.

Big savings reported!

One utility makes fuel savings alone estimated at $2.00 per day per truck. Another cites an annual saving of $800.00 per truck. This is based on battery charging output only. In addition, the A.C. output makes possible replacing hand tools with electric tools . . . saving time and money.

Vacu-Flo cooling permits enclosed installations



Vacu-Flo cooling is a low-cost optional feature on Onan air-cooled plants up to 10,000 watts.

Other Onan Models 500 to 200,000 watts A.C., D.C. and Battery Charging.

Write for folder showing 3 Packaged Power Systems

Onan ELECTRIC PLANTS

D.W. ONAN & SONS, INC.

2834A University Ave. S.E., Minneapolis 14, Minn.

Warren H. Bulloch, formerly president of Southern Utah Power Co, has been selected as a member of the board of California-Pacific Utilities Co, following the merger of Southern Utah with it. **Ralph R. Thomas,** previously Southern Utah vice president, continues as Vp-southern Utah division of the new company.

Harry T. Smith has been selected to fill the position of engineer in charge of research and purchasing for the Kentucky Rural Electric Cooperative Corp, a service organization owned by 22 rural electric co-ops throughout Kentucky.

Recently promoted to assistant chief engineer by Minnesota Power & Light Co, was **Jack F. Rowe.**

Four management promotions have been made by Mississippi Power & Light Co. **Joe H. Box** has been made manager of the utility's western division; **C. Lamar Stephenson** succeeds him as assistant to the central manager. **John Craft** goes to Jackson as operating assistant, and **Joe Hinds** is new Greenville division manager.

Robert H. Sims has been advanced to assistant superintendent of transmission for Jersey Central Power & Light and New Jersey Power & Light. Stepping in as new coast division manager is **Edwin M. Ambler.**

Lee K. Habel has been named superintendent of gas, electric, and steam distribution operations by Washington Water Power Co.

Recently named manager of Magic Valley Electric Co-operative, Mercedes, Texas, was **George King, Jr.**

Ray Hoidal has been appointed chief civil engineer in charge of project engineering for Seattle City Light.

Southern California Edison Co announces the promotion of **James H. Drake** to superintendent of system operation.

Texas Power & Light Co has made **W. S. Hills** Athens District manager. New assistant to the manager of the Paris district is **John E. Davis.**

George W. Kindon, supervisor of Philadelphia Electric Co's advertising department, has been elected president of the Public Utilities Manufacturers Association.

Circle Wire and Cable Corp has named **Gayle Lewis** district sales manager with responsibility for the company's overall sales activities in the Midwest.

C. H. Leet has been promoted by Exide Storage Battery Co to head the national marketing program for the company's battery charger line.

New manager of the export region of Kellogg Switchboard & Supply Co is **John A. Russell.** Also at Kellogg, **K. C. Tompers** has been made field sales manager.

Foster Wheeler Corp has announced the advancement of **William A. Martin** to general manager of the company's equipment division.

OBITUARIES

N. V. Palmer and E. S. Chapin, both of EW's advertising sales staff, died recently.

Palmer had been with McGraw-Hill for 32 years. He joined EW in 1941, and was Atlantic District manager.

Chapin came to McGraw-Hill in 1948, and to EW in 1950. He was New England manager.

N. PALMER E. CHAPIN

NOW Is The Time To Invest In The West

The West's share of the nation's electrical power industry expenditures is growing bigger every year, following this pattern:

1949.....16.1%
1954.....17.4%
1957.....21.0%
1958.....21.5%

At the present time the West with 15% of the country's people consumes 19.2% of the electrical energy, builds 26% of the country's homes, and accounts for 24.6% of the engineered construction backlog.

That's why many alert electrical manufacturers right now are profitably stepping up manufacturing, marketing and advertising efforts in the West.

WHEN WE LOOK AHEAD A FEW YEARS THE IMPORTANCE OF TODAY'S SELLING INVESTMENT IN THE WEST BECOMES EVEN MORE SIGNIFICANT

Between 1959 and 1975 total U. S. population growth, will be 20.9%—11 Western States' increase will be 50.1%. The West will add 14.8 million people in this period, far more than any other region.

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HA-3

Over-Water Line

(*Continued from page* 63)

The base shoes were completely sealed from the sea water with a cement mortar grout.

The assembly and erection of the towers were worked out smoothly. All tangent and the two deadend towers were assembled on shore at Galveston Island or Virginia Point, whichever was closer to the proposed site. Towers were picked up on the heavy side of the balance point by a 23-ton motor crane and on the top end by an A-frame truck. The assembled tower was carried down Old Galveston Causeway, the truck leading to a point where the water was deep enough to float a barge.

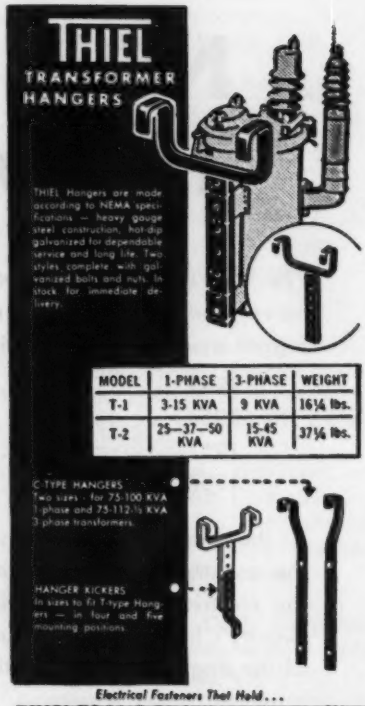
Towers were re-hooked at the balance point and loaded on a barge by motor crane. They were then conveyed to foundations and set in place by the Whirley crane. The two special 139-ft horizontal-configuration, crossing towers being too large to handle when completely assembled, were erected piece-by-piece by crane and gin pole methods, erection crews working from barges.

As a tug or barge could be driven in a hurricane into a tower at the Intracoastal Waterway, three protective dolphins were placed near each on each side of the waterway. These are 54-in. OD, 40 ft long prestressed concrete cylinder piles filled with concrete to the mud line to add mass. Foundations for the 27 towers took 150 days for construction; tower erection 60 days.

Canada Computer Session to Explore Digital Uses

The first international session devoted to digital computer applications in the power industry will be held in Toronto, Canada Sept. 15-17. Sponsored by the American Institute of Electrical Engineers, the meeting will include presentation of 21 papers.

Five sections will explore digital computer uses in the design of rotating and non-rotating machinery, system analysis and design, operating problems, and system economic studies. J. R. Leslie, Ontario Hydro, 620 University Ave., Toronto, is handling information on registrations and accommodations.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Silicone Insulations

(*Continued from page* 88)

rubber to the 5,000-v class, although development by silicone producers and wire and cable manufacturers may increase this range. Laboratory results have been promising on experimental lengths of 15-kv cables insulated with extruded silicone.

The thickness of insulation for extruded silicone rubber is the same as that specified for the conventional rubbers. But like the organic rubbers, silicone rubber may be modified chemically in many ways to obtain materials with specific desired properties. Manufacturers are producing polymers with high tensile strength, which have applications not only for insulations, but also for jackets. Compounds of very low water absorption have been developed.

High-voltage power cables are shielded for many reasons—to protect insulation from abnormal stresses, to eliminate ionized air with accompanying corona and ozone, and to protect animal life. In general, silicone 5,000-v cables are not shielded, but shields are used on 15-kv cables. Communication and control cables may need shielding, particularly those in an area with strong fields prone to interfere with transmitted signals.

Coverings Developed

Cable insulations in general are protected with an outer covering largely for mechanical reasons. An asbestos braid has proved satisfactory for silicone-insulated power cable applications up to 5,000 v, such braid being saturated with materials that resist flame and moisture. Glass braids are used over silicone-insulated power cables to some extent.

Silicone compounds, recently developed, may be satisfactory as outer covering. And also recently, a corrugated metallic tubular sheath has been developed which can be applied over silicone conductors. This sheath is a truly impervious metallic barrier which, like a conduit, protects a conductor from gases and liquids as well as from mechanical damage. The sheath, unlike lead, doesn't lose its strength at the operating temperatures of silicone.

Unique Transformer Jack Lifts Full Capacity on Toe or Cap

Exclusive design accounts for the success of this series of jacks. The roller bearing in the toe transmits eccentric toe loading to the flat milled surface on the stationary ram. This completely eliminates scoring action which is inherent in conventional toe lift hydraulic jacks. Lifts full capacity on both the toe or the cap.

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Jack No.	Capacity Tons	Weight Lb.	Closed Height Inches	Travel Inches	Toe	Base: Forked Design
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TJ-25	25	110	14	7	Min. Ht. 2½" Width 4½"	9"x12"
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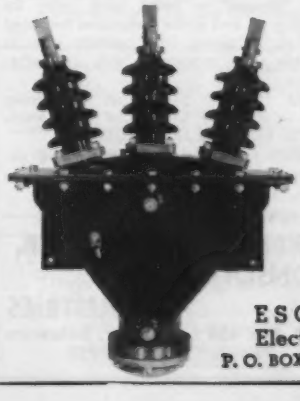

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The Meetings Calendar

AUGUST

• **American Public Power Association**—Fourth Annual Accounting & Finance Workshop, Hotel Benjamin Franklin, Seattle, Wash., Aug. 13-14.

World Power Conference — Sixth International Congress on Large Dams, Statler Hotel, New York City, Sept. 15-20.

American Institute of Electrical Engineers — Pacific General Meeting, Sacramento, Calif., Aug. 19-22.

SEPTEMBER

Edison Electric Institute — Accounting Division and Section Organization Meeting, sponsored jointly with AGA, Netherland Hilton Hotel, Cincinnati, Ohio, Sept. 8-9; Industrial Power & Heating Group, Wisconsin Dells, Wisc., Sept. 18-19; Meter and Service Committee, Driscoll Hotel, Corpus Christi, Texas, Sept. 22-24; Industrial Relations Committee Round Table Conference, Hotel Drake, Chicago, Ill., Sept. 29-Oct. 1.

Northwest Public Power Association, Inc—Power Use Section Annual Meeting, Malaspina Hotel, Nanaimo, British Columbia, Sept. 10-12.

Maryland Utilities Association — 34th Fall Conference, The Cavalier-Sir Walter Raleigh Hotel, Virginia Beach, Va., Sept. 12-13.

Rocky Mountain Electrical League—Annual Fall Convention, Jackson Lake Lodge, Moran, Wyo., Sept. 14-17.

Pennsylvania Electric Association—51st Annual Meeting, Penn Sheraton Hotel, Pittsburgh, Pa., Sept. 17-18.

Northwest Electric Light & Power Association—51st Annual Meeting, Sun Valley Lodge, Sun Valley, Idaho, Sept. 17-19.

Public Utilities Association of the Virginias—40th Annual Meeting, Greenbrier Hotel, White Sulphur Springs, W. Va., Sept. 18-21.

• **Missouri Valley Electric Association**—Accounting Conference, Robidoux Hotel, St. Joseph, Mo., Sept. 25-26.

American Society of Mechanical Engineers—Power Division Conference, Hotel Statler, Boston, Mass., Sept. 28-Oct. 1.

OCTOBER

Indiana Electric Association—Annual Convention, French Lick-Sheraton Hotel, French Lick, Ind., Oct. 1-3.

Electric Companies Public Information Program—Workshop Conference, Radisson Hotel, Minneapolis, Minn., Oct. 1-3.

• **Missouri Valley Electric Association**—Sales & Rural Conference and Home Service Workshop, President Hotel, Kansas City, Mo., Oct. 1-3.

Edison Electric Institute — Prime Movers Committee, Hotel Statler-Hilton, Buffalo, N. Y., Oct. 6-8; Transmission & Distribution Committee, Hotel New Yorker, New York City, Oct. 9-10; Electric System and Equipment Committee, Hotel Barringer, Charlotte, N. C., Oct. 13-14; 5th Annual Area Development Workshop, Hotel Somerset, Boston, Mass., Oct. 15-16; Taxation Accounting Committee, co-sponsored by AGA, Tides Hotel and Bath Club, St. Petersburg, Fla., Oct. 22-24.

Wisconsin Utilities Association—Electric and Gas Operations & Sales Convention, Schroeder Hotel, Milwaukee, Oct. 15-17.

Pennsylvania Electric Association—Prime Movers Committee, Skytop Lodge, White Haven, Pa., Oct. 16-17.

Southeastern Electric Exchange—Engineering & Operation Section, Hotel Roanoke, Roanoke, Va., Oct. 20-21; Accounting Conference, Roosevelt Hotel, New Orleans, La., Oct. 30-31.

• **American Institute of Electrical Engineers** — Fall General Meeting, Pittsburgh, Pa., Oct. 27-31.

• Additions this week.

MORE BIG DATES FOR '58

National Electrical Manufacturers Association—Annual Meeting, Atlantic City, Nov. 10-14.

National Association of Railroad and Utilities Commissioners—Annual Convention, Westward Ho Hotel, Phoenix, Ariz., Nov. 17-20.

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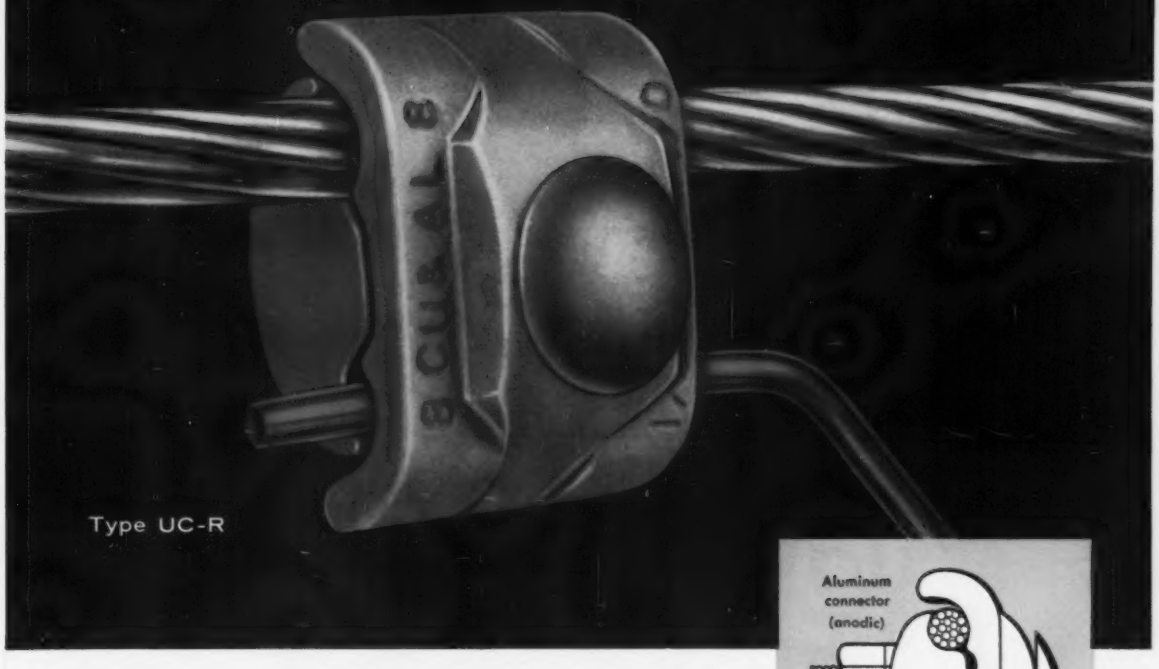

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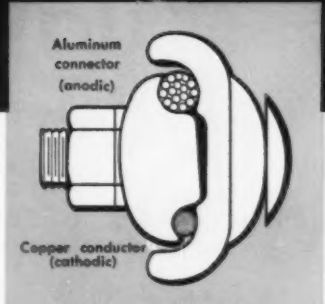

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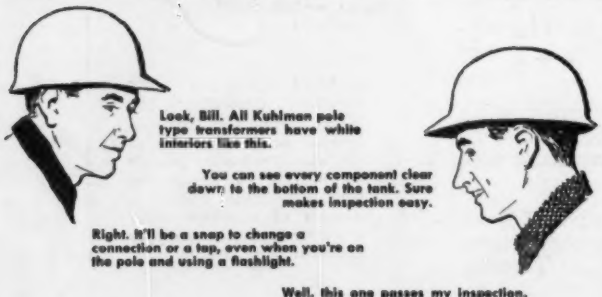
Linemen like this Feature...

KUHLMAN transformers are WHITE inside


Look, Bill. All Kuhlman pole type transformers have white interiors like this.
You can see every component clear down to the bottom of the tank. Sure makes inspection easy.
Right. It'll be a snap to change a connection or a tap, even when you're on the pole and using a flashlight.
Well, this one passes my inspection. Let's hoist her up.

White interiors—a Kuhlman exclusive—make periodic inspection faster and surer by helping the lineman see clearly all the way to the bottom. This much-appreciated feature doesn't add a penny to the cost, however. Kuhlman's dual-flow paint system sprays exterior gray and interior white simultaneously, preparing the tank for the bake oven in one operation.

Look into a light, *white* Kuhlman transformer. You'll see the advantage of white interiors right away!

KUHLMAN ELECTRIC COMPANY

General Offices: Birmingham, Michigan

BAY CITY, MICHIGAN • CRYSTAL SPRINGS, MISSISSIPPI • SALINAS, CALIFORNIA